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ABSTRACT

Survey instruments were mailed to all of Maine's secondary school principals and mathematics teachers. The purpose of these instruments was to: (1) measure the status quo of mathematics education in Maine's secondary shools; (2) measure the background and interests of Maine's mathematics teachers; and (3) obtain an indication of the graduate courses these teachers were interested in taking. Useable responses were returned by 115 principals (60.5%) and 433 teachers (45.1%). The list of mathematics, mathematics education, and graduate education courses desired by Maine's secondary school mathematics teachers was compared to the list of courses recommended by the National Council of Teachers of Mathematics Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics. Over 82% of responding teachers were interested in taking a mathematics or mathematics education course via interactive television. Maine's secondary school mathematics teachers who were certified to teach mathematics included 27.4% who did not have either a mathematics major or minor when they received their bachelor's degree. The majority of Maine's secondary school mathematics teachers who were not certified did not have a mathematics major or minor. Almost all principals reported that they encourage their teachers to pursue professional development activities; however, only 65.1% of the teachers reported that their administrators encourage them to pursue such activities. (CW)

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A SURVEY OF MAINE'S SECONDARY SCHOOL PRINCIPALS AND MATHEMATICS TEACHERS

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A SURVEY OF MAINE'S SECONDARY SCHOOL PRINCIPALS AND MATHEMATICS TEACHERS

by

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October 1988

Abstract

Survey instruments were mailed to all of Maine's secondary school principals and mathematics teachers. The purpose of these instruments was to measure the *status quo* of mathematics education in Maine's secondary schools, to measure the background and interests of Maine's mathematics teachers, to obtain an indication of the graduate courses these teachers are interested in taking and to use these results to help determine what should be included in a graduate program in mathematics education at the University of Maine. Useable responses were returned by 115 (60.5%) of the principals and 433 (45.1%) of the teachers.

The list of mathematics, mathematics education and graduate education courses desired by Maine's secondary school mathematics teachers were compared to the list of courses recommended by NCTM's Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM). Among the findings were the following: The four mathematics courses that received the highest ranking from Maine's secondary school mathematics teachers were History of Mathematics, Probability, Theory of Equations and Discrete Mathematics. All except Theory of Equations are among those recommended by NCTM's PBETM Task Force. Problem Solving, Teaching of Algebra, Teaching of Geometry and Teaching of Advanced Topics were the four highest ranked mathematics education courses. Only the Problem Solving course is on the list developed by the PBETM Task Force. Computers in Education and Tests and Measurements were the top two general education courses. The second of these is on the PBETM list. While Computers in Education is not on the PBETM list it does contain much of the content in one of NCTM's courses—"Technology in Secondary School Mathematics."

Other results of this survey that are of interest include: A total of 158 teachers who responded indicated an interest in pursuing a master's degree from the University of Maine. These 158 teachers represent 66.4% of those teachers who do not have a master's degree. Over 82% of responding teachers are interested in taking a mathematics or mathematics education course via interactive television. Maine's secondary school mathematics teachers who are certified to teach mathematics included 27.4% who did not have either a mathematics major or minor when they received their bachelor's degree. The majority (80.5%) of Maine's secondary school mathematics teachers who are *not* certified did not have a mathematics major or minor. Almost all (96.3%) principals reported that they encourage their teachers to pursue professional development activities. However, only 65.1% of the teachers reported that their administrators encourage them to pursue such activities.

Executive Summary

> I am teaching a Pre-Algebra class because I have to. I have no choice. I have had all of 1 semester of Algebra in college and received a D because I had never had Algebra in high school and my college class was taught as a review. I am hoping to be teaching in my area ... all of my 6 classes next year. I am doing my best however I still feel I am cheating my Pre-Algebra students. Even the Math Dept. does not like teaching these classes (because of discipline problems) which is why I am teaching such a class! I am teaching myself the best I can, but I am not comfortable.

In January 1988, a survey instrument was mailed to Maine's secondary school principals. At the same time, a second related instrument was mailed to Maine's secondary school mathematics teachers. The opening quote was taken from one teacher's returned survey. While this quote reads as a "horror story," it is not from someone who considers him/herself as a mathematics teacher. The following quote is taken from a math teacher.

> Without question the greatest need in our school is the need for qualified math teachers to teach our slower students in general math, bus. math, consumer math, etc. Our college math program is handled by qualified teachers. These other courses are thrown on teachers as extra fill-ins when their field may be English, science, home ec., etc. I think the teachers do their best, but do not have the background, and then it's the student who gets hurt. We need stronger courses to strengthen our weaker students' background!!

The purpose of these instruments was to obtain a "snapshot" of Maine's secondary schools and their mathematics teachers and to obtain an indication of the graduate courses these teachers are interested in taking. Useable responses were returned by 115 (60.5%) of the principals and 433 (45.1%) of the teachers. This Executive Summary contains the important aspects of the 137 page report in which the returned survey instruments are analyzed.

Summary

The most significant findings are that

- 66.4% of those teachers who do not have a master's degree indicated an interest in pursuing such a degree from the University of Maine.
- Over 82% of responding teachers are interested in taking a mathematics or mathematics education course via interactive television.
- 27.4% of Maine's secondary school mathematics teachers who are certified did not have either a mathematics major or minor when they received their bachelor's degree.
- 80.5% of Maine's secondary school mathematics teachers who are *not* certified did not have a mathematics major or minor.

Of particular interest to the University of Maine was the lists of mathematics, mathematics education and graduate education courses desired by Maine's secondary school mathematics teachers. Table 1 summarizes these results by listing the courses in the order in which Maine's secondary school mathematics teachers ranked each course and by indicating if the course was recommended by NCTM's Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM).

The findings in Table 1 indicate that:

- The four mathematics courses that received the highest ranking from Maine's secondary school mathematics teachers were History of Mathematics, Probability, Theory of Equations and Discrete Mathematics. All except Theory of Equations are among the recommended courses of NCTM's PBETM Task Force.
- Problem Solving, Teaching of Algebra, Teaching of Geometry and Teaching of Advanced Topics were the four highest ranked mathematics education courses by Maine's secondary school mathematics teachers.

Table 1

COMPARATIVE LIST OF MATHEMATICS, MATHEMATICS EDUCATION AND GENERAL EDUCATION COURSES AS RANKED BY MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS AND WHETHER LISTED BY NCTM'S PBETM TASK FORCE

	Mathematics		Mathematics Education		General Education	
Rank by Teachers	Title	NCTM list?	Title	NCTM list?	Title	NCTM list?
1	History of Math	Y**	Problem Solving . . .	Y	Computers in Ed	
2	Probability	Y	Teaching Algebra		Tests & Meas‡‡	Y
3	Theory of Equations	Y*	Teaching Geometry		Adv. Ed Psych	
4	Discrete Math	Y	Teach Adv. Topics		Statistics In Ed	
5	Number Theory		Models of Teaching**	Y	Cur & Org	
6	Geometric Linear Alg.		Current Curriculum	Y	Intro to Ed Res.	
7	Algebra	Y	Technology in SSM	Y		
8	Statistics	Y	Diag. and Remed†	Y*		
			Psych. of Teaching‡†	Y		
9	Non-Euclidean Geom.	Y				
10	Adv. Euclidean Geom.	Y	Teaching Mid/Jr H.			
11	Approx. Methods					
12	Modern Analysis†	Y				
	Numerical Analysis†					
14	Advanced Calculus					

* Listed by NCTM in September 1987 draft, but not listed in January 1988 draft report of PBETM
** Not listed by NCTM in September 1987 draft, but listed in January 1988 and June 1988 drafts
*** January 1988 Task Froce report changed title from "Models of Teaching and Instructional Strategies for Secondary School Mathematics" to "Mathematics Instruction in Grades 7–12"
‡ January 1988 PBETM report listed title as "Psychology of Mathematics Learning"
‡‡ January Task Force report changed title from "Tests and Measurements" to "Evaluation of Student Learning"
† tie

Only the Problem Solving course is on the June 1988 draft list developed by NCTM's Task Force.

- Computers in Education and Tests and Measurements were the top two general education courses of Maine's mathematics teachers. The second of these is on NCTM's list. While Computers in Education is not, it does

contain much of the content in one of NCTM's courses—Technology in Secondary School Mathematics.

There were some other interesting results. While each of these results, listed below, will not impact on the development of a graduate program in mathematics education at the University of Maine, they may deserve to be studied further to see if the data are consistent and to determine some possible causes and/or solutions.

- There is a correlation of $r = 0.902$ between the percent of schools that subscribe to professional mathematics education journals and the journals that are read by secondary school mathematics teachers.
- 96.3% of principals reported that they encourage their teachers to pursue professional development activities in mathematics. However, only 65.1% of the teachers reported that their administrators encourage them to pursue such activities.

Teachers and principals commented on ways to improve mathematics education. Both groups had essentially the same concerns.

- They want better non-college preparatory mathematics courses. As one teacher said "'General mathematics' courses are a joke."
- They want more realistic and better applications of mathematics.
- They want more realistic and better career-oriented mathematics.
- They want better prepared teachers—not only at the high school, but at the middle and elementary levels. Almost 28% of the principals commented on the need for better qualified teachers
- In order to update, maintain and improve their teaching, teachers want graduate level mathematics and mathematics education courses and they wanted them offered at times and locations when they can attend, i.e. closer to their school sites. As two teachers said:

"I would like to see a more flexible schedule for courses at Orono. One night a week for 15 weeks is more than I want to take on at this point although I would enjoy some chances to talk and learn more about mathematics."

"I would love to have a Masters degree in mathematics, but the remote area I live in makes it difficult to do so. Orono should offer extensive use of telecommunications system."

- Teachers expressed a need for some course designed to help them update skills, such as calculus, that have declined through disuse
- Principals and teachers believe there is a need for better communications among people teaching all levels of mathematics. This included intra- as well as inter-school communication.

Next Steps

This was the first step in looking at the *status quo* of secondary school mathematics in the state of Maine and in determining the needs of Maine's schools and their mathematics teachers. The results of this study will be used to help determine the feasibility of, and what should be included in, a graduate program in mathematics education at the University of Maine. Whenever a new program is initiated, the following must be taken into consideration:

- Standards of accrediting associations such as the National Council for the Accreditation of Teacher Education (NCATE)
- Recommendations of professional organizations such at the National Council of Teachers of Mathematics (NCTM) and the Mathematical Association of America (MAA)
- Concerns, interests and needs of the people the program will primarily serve, in this instance the mathematics students and teachers of Maine.

Preferences of Maine's secondary school mathematics teachers differ in several instances from the draft recommendations of NCTM's Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM). One of the next steps is to attempt to resolve these differences in order to design a model mathematics education curriculum for Maine. The latest version of NCTM's *Guidelines for the Preparation of Teachers of Mathematics* is used by NCATE when its members examine an undergraduate teacher education program. Will the recommendations of the PBETM Task Force become the *de facto* standards for judging graduate programs in mathematics education?

Many teachers expressed concern and frustration in their difficulty in finding courses at convenient times and locations The mathematics teachers of Maine are asking for help.

- It is imperative that the University do everything possible to provide mathematics (and education) courses at times and locations that allow Maine's mathematics teachers to go to school in the evening or summer. As one teacher said "I am presently trying to find a way to work towards my M.Ed. in ME. However, it is not offered in the State of ME. I live very close to NH but UNH will be expensive. It is very frustrating and disappointing that ME won't help me to meet my goals."

The University of Maine's Centers for Educational Excellence are one model that has been developed to help do this. The opening quotations indicate that Maine's mathematics teachers want to be better, and the children of Maine deserve better mathematics teachers.

Another step that needs to be undertaken is to conduct similar surveys of Maine's elementary school and middle level teachers. How well do they feel their undergraduate program prepared them for teaching mathematics? Where do they feel a need for a stronger mathematics background? How should the undergraduate mathematics program be changed? What types of graduates level mathematics and mathematics education courses are of interest?

* * * * *

This report constituted the end of one step toward improving mathematics education in Maine. There are many more steps that need to be taken so that Maine's teachers are providing the best mathematics education possible for Maine's school children.

Acknowledgments

Many people contributed to this report. Some were involved at the beginning as the instruments were designed. Others provided input at later stages as the surveys were received and data from them were analyzed. This is an opportunity for the author to thank each one for his or her contribution.

First, I would like to thank the teachers and principals who took their time to answer the survey. I hope that the findings included in this report will provide the best way to truly reward their efforts—improved mathematics education in Maine.

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I. Introduction

Many reports have been issued in the last five years on the status of education in the United States. Most notable of these was the first report, *A Nation at Risk: The Imperative for Educational Reform* (1983). This report was prepared at the request of U. S. Secretary of Education Terrel Bell and set the tone for education reform in this country with the title of the report and with this opening paragraph.

> Our Nation is at risk. . . . The educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people. What was unimaginable a generation ago has begun to occur—others are matching and surpassing our educational attainments. (National Commission on Excellence in Education, 1983)

This report was quickly followed by other reports espousing educational reform. Among these are the following.

May 1983: *Academic Preparation for College: What Students Need to Know and Be Able to Do*, The College Board.

August 1983: *High School: A Report on Secondary Education in America*, Carnegie Foundation for the Advancement of Teaching (Boyer, 1983)

1985: *A Call for Change in Teacher Education*, National Commission for Excellence in Teacher Education.

1986: *Tomorrow's Teachers: A Report of the Holmes Group*, The Holmes Group

1986: *A Nation Prepared: Teachers for the 21st Century*, Carnegie Task Force on Teaching as a Profession

The Status of Mathematics Teaching

The public has been paying more attention to both the quantity and quality of secondary school mathematics teachers. The quantity is of concern because many reports predict an impending severe shortage. House (1982) reported on the coming mathematics teacher shortage by calling mathematics teachers an "endangered species." A special section of the June 1986 issue of *Phi Delta Kappan* was dedicated to the teacher shortage. Hawley (1986) discussed the consequences of various policies that affect the supply and demand of teachers. Haberman (1986) looked at teacher licensing. Roth (1986) discussed emergency certificates, misassignments, etc. McGeever (1984) discussed the expected national shortage of science and mathematics teachers and presented some of the state and local initiatives which might help to alleviate the shortage.

All of these reports galvanized the Nation to initiate many reforms in the Nation's schools and in the preparation of teachers. The mathematics education community is torn by the issues of quantity and quality. On one hand, the quantity issue speaks to the fact that today's schools have a shortage of qualified mathematics teachers. On the other hand, the quality issue raises questions about whether today's existing mathematics teachers are underprepared. Evidence for this comes from *The Underachieving Curriculum* (McKnight, 1987), a national summary of the Second International Mathematics Study in which it was revealed that the United States was at, or below, the international average on most measures. Furthermore, the results of the fourth administration of the mathematics component of the National Assessment of Educational Progress (NAEP) indicated that "there are serious gaps in student's knowledge, and that they are learning a number of concepts and skills at a superficial level." (NCTM, 1988) If these gaps in the mathematics knowledge and understanding of the Nation's children are to be narrowed, then

several changes must be considered. Among these are improvements in both the preservice and inservice preparations of mathematics teachers is needed.

The National Council of Teachers of Mathematics (NCTM), the National Research Council, and the Mathematical Association of America (MAA), all had committees actively pursuing reforms in mathematics teacher education. For example, in 1973, the NCTM published the *Guidelines for the Preparation of Teachers of Mathematics*. These Guidelines were revised in 1981 (Commission on the Education of Teachers of Mathematics, 1981) and are used by the National Council for the Accreditation of Teacher Education (NCATE) when it examines teacher education programs. The MAA's Committee on the Continuing Mathematical Education of Teachers (COMET) is preparing a set of *Guidelines for the Continuing Mathematical Education of Teachers* (Mathematical Association of America, 1988).

The mathematical preparation of teachers should not stop with the awarding of a teaching degree. In awareness of this, NCTM appointed a Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM). About the same time, and with the awareness that only 29% of Maine's teachers have master's degrees (compared to 51.9% in the U. S.), the College of Education at the University of Maine decided to initiate a graduate program in mathematics education. Additional impetus was given to the development of that program at the July 11, 1988, meeting of the University of Maine System Trustees when Eve Bither, State Commissioner of Education "floated the idea of requiring teachers to get a master's degree within a fixed period of time after they are licensed." (Bangor *Daily News*, 1988)

Purpose

There is considerable interest in Maine for obtaining better prepared teachers. As part of that interest, it was decided that a graduate program in mathematics education should be initiated at the University of Maine. Whenever a new program is initiated, the following must be taken

into consideration:

- Standards of accrediting associations such as the National Council for the Accreditation of Teacher Education (NCATE)
- Recommendations of professional organizations such at the National Council of Teachers of Mathematics (NCTM) and the Mathematical Association of America (MAA)
- Concerns, interests and needs of the people the program will primarily serve, in this instance the mathematics students and teachers of Maine.

The first two items above could be accomplished by reading the standards of accrediting associations and the recommendations of professional organizations. As was mentioned above, the NCTM appointed a Task Force to develop Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM). The author has been in frequent communication with the chair of the PBETM Task Force.

The third item listed above requires that some process be used to determine the concerns, interests and needs of Maine's secondary school mathematics teachers, their schools and their students. To do this, two surveys were conducted. One survey was sent to the principals of Maine's secondary schools and the other was sent to Maine's secondary school mathematics teachers. The specific purposes of these surveys were to obtain a measure of the *status quo* of mathematics education in Maine's secondary schools and to conduct a needs assessment of the types of courses desired by Maine's secondary school mathematics teachers, locations where they would be willing to take these courses, and the current concerns of principals and teachers regarding the mathematics program in their schools and in the state. This report contains the results and analyses of these surveys. The results of these needs assessments will be used, in consideration of standards and recommendations of the NCATE, NCTM and MAA, to develop a graduate program in mathematics education for the University of Maine.

* * * * *

The remainder of this report consists of five sections. Section II describes the development and distribution of the surveys. Section III reports the statistical data from the Principal's Survey. Some of the quantitative data from the Teacher's Survey are in Section IV with several references to analogous data from principals. In Section V, the Teacher's Survey is further analyzed as to the types of graduate courses desired by the respondents and the location where they would prefer taking each course. The last section contains a summary of the results and a list of steps that should be taken to develop a graduate mathematics education program at the University of Maine.

II. The Survey

In January 1988, separate questionnaires were mailed to members of two groups. One group consisted of all secondary school principals in the state of Maine. The second group consisted of the secondary school mathematics teachers in Maine. Mailing labels for these two groups were obtained from the Department of Educational and Cultural Services (DECS), the state education agency for Maine. As will be seen, it appears that the mailing labels for the teachers were incomplete since only 106 of the 433 (24.5%) respondents indicated they were in a school that included grades 6, 7 or 8. Examination of the returned surveys indicated that no K–8 schools were included in the mailing.

Several sources where consulted in order to develop the list of questions on the surveys. Among these were similar studies (Holtan, 1986 and Schroeder & Frame, 1986); a copy of a survey instrument sent by the National Council of Teachers of Mathematics to some of its members, and draft reports of the Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM) of NCTM (Dessart, 1987; Dessart, 1988a). Many items on the Teacher Survey were included because they were in the initial drafts of the PBETM Task Force's report. Preliminary results of this survey have been reported to the chair in order to provide some feedback to the Task Force from the teachers of Maine. Mathematics, mathematics education, and general education courses were obtained from the draft PBETM reports, by examining the catalogs of universities with strong mathematics education programs

(Sonnabend, 1981) and through consultation with members of the Mathematics Department and the College of Education at the University of Maine.

Survey instruments were mailed to principals of 190 schools. Useable responses were received from 115 (60.5%) of these schools. A second survey instrument was mailed to 960 secondary school mathematics teachers. One uncompleted instrument was returned with a note which stated that the respondent was not teaching mathematics this year and did not believe it would be appropriate for her to respond. A total of 433 (45.1%) useable forms were completed and returned. A copy of the survey instruments and the accompanying cover letters are in Appendix A.

Table 1 shows the numbers of responses received from principals and teachers in each of

Table 1

NUMBER AND PERCENT OF RESPONSES SORTED BY COUNTY

	Principals		Teachers	
County	Number	Percent of total	Number	Percent of total
Androscogin	7	6.3	36	8.4
Aroostook	14	12.5	36	8.4
Cumberland	16	14.3	81	18.8
Franklin	4	3.6	14	3.2
Hancock	5	4.5	12	2.8
Kennebec	9	8.0	36	8.4
Knox	4	3.6	9	2.1
Lincoln	4	3.6	10	2.3
Oxford	7	6.3	26	6.0
Penobscot	14	12.5	57	13.2
Piscataquis	3	2.7	9	2.1
Sagadahoc	2	1.8	8	1.9
Somerset	4	3.6	26	6.0
Waldo	3	2.7	9	2.1
Washington	6	5.4	12	2.8
York	10	8.9	50	11.6
TOTAL	112*	100.0	431*	100.0

*Three principals and two teachers did not indicate the county where their school was located.

the 16 counties of Maine. A correlation between the percentage of respondents and the number of surveys mailed to each group resulted in an r = .908. A map of Maine showing its 16 counties is in Figure 1.

In addition to the count of each respondent's school, there was one other pertinent question that was common to both surveys. This question asked for the size of each respondent's school. Table 2 shows the total and percent of responses from principals and teachers sorted by the size of the school. It also shows the percent of full-time mathematics teachers that principals indicated were in each size of school. A correlation between the percent of respondents to the

Figure 1

Teacher's Survey [column (5)] and the percent of full-time mathematics teachers [column (3)] gives a value of r = 0.977.

Table 2

NUMBER AND PERCENT OF RESPONSES
FROM PRINCIPAL'S AND TEACHER'S SURVEYS SORTED BY SIZE OF SCHOOL

	Principal's Survey			Teacher's Survey	
Size of school	(1) No. of principals at schools with this no. of students	(2) % of principals at schools with this no. of students	(3) % of full-time teachers at schools this size	(4) No. of teachers at schools with this no. of students	(5) % of teachers at schools with this no. of students
Under 100	6	5.2	2.6	11	2.6
100-299	26	22.6	13.6	64	14.9
300-499	34	29.6	20.7	109	25.3
500-1000	39	33.9	43.5	177	41.2
over 1000	10	8.7	19.6	69	16.0
TOTAL	115	100.0	100.0	430	100.0

These two correlations indicate that the responses by principals and teachers were consistent according to the distributions by county and by school size. Thus, it is reasonable to assume that the data from these two groups represent the same types of schools.

* * * * *

In this section, the process of developing the two surveys and the demographics of the respondents have been discussed. The next section contains a detailed look at the results of the Principal's Survey.

III. Principal's Survey

The analysis of the Principal's Survey considers the nature of the teachers, the school facilities, and the principal's perception of the professionalism of Maine's secondary school mathematics teachers. The nature of the questions on the Principal's Survey means that it provides a more complete picture of Maine's secondary schools than does the Teacher's Survey.

The Teachers

Table 3 includes the total number of full-time and part-time teachers in the schools sorted by the size of the school. Table 3 also includes data on the average number of full- and part-time

Table 3

TOTAL AND AVERAGE NUMBER OF FULL- AND PART-TIME TEACHERS SORTED BY SIZE OF SCHOOL

Size of school	Number of full-time teachers	Average number full-time teachers	Number of part-time teachers	Average number part-time teachers
Under 100	48	8.00	7	1.17
100-299	544	20.92	53	2.04
300-499	909	26.74	53	1.56
500-1000	1715	43.97	75	1.92
over 1000	722	72.20	23	2.30
TOTAL	3938	34.24	211	1.83

teachers in each school. It is interesting to note that the schools with between 100–299 students have almost as many teachers, on the average, as do schools with 300–499 students.

In Table 4, similar material is presented as it focuses on the total and average number of full- and part-time mathematics teachers in each school size category. Here it can be seen that there is no appreciable gain in the average number of mathematics teachers as one progresses from schools with fewer than 100 students to schools with 300–499 students. At this point, the average number of mathematics teachers doubles in the next largest category and almost doubles again at the next largest category. The middle-sized schools, those with 300–1000 students, have the most part-time mathematics teachers. According to the National Center for Education Statistics, 15.8% of public school secondary school teachers nationally are mathematics teachers. According to these principals, 455 of their 3938 full-time teachers (11.6%) are mathematics teachers. On the other hand, 121.5 of the 211 part-time teachers (57.6%) are hired as teachers of mathematics. Nationally 15.8% of all (both full- and part-time) secondary school teachers are mathematics teachers.

It is somewhat interesting to note that schools with less than 100 students have the fewest

Table 4

TOTAL AND AVERAGE NUMBER OF FULL- AND PART-TIME MATHEMATICS TEACHERS SORTED BY SIZE OF SCHOOL

Size of school	Total no. of full-time math teachers	Average no. of full-time math teachers	Total no. of part-time math teachers	Average no. of part-time math teachers	% of part-time to full-time math teachers
Under 100	12	2.00	2	0.33	16.7
100-299	62	2.38	27	1.04	43.5
300-499	94	2.76	39	1.15	41.5
500-1000	198	5.08	44.5	1.14	22.5
over 1000	89	8.90	9	0.90	10.1
TOTAL	455	3.96	121.5	1.06	26.7

number of part-time teachers. Because these schools are often in rural areas, it is often assumed that they would have more difficulty locating full-time teachers. This does not appear to be the case. The next table will provide some information about the qualifications of these mathematics teachers.

Table 4 contained numbers of mathematics teachers. How qualified are they to teach mathematics? One measure of a teacher's qualification is whether the teacher has a state teaching certificate. Often schools need to request emergency certification for a teaching applicant in order to have sufficient numbers of teachers. Table 5 provides some insight into the qualifications of the state's mathematics teachers.

Table 5 contains the total and average number of full- and part-time mathematics teachers who are not certified to teach mathematics. The percent of full- and part-time mathematics teachers is also provided. This percent was computed by dividing the number of non-certified mathematics teachers in this table with the total number of mathematics teachers in Table 4.

Examination of Table 5 does not show any unexpected results. As can be seen, 7% of the full-time mathematics teachers are not certified. When the school's size is taken into

Table 5

TOTAL NUMBER, AVERAGE, AND PERCENT
OF FULL- AND PART-TIME MATHEMATICS TEACHERS
WHO ARE NOT CERTIFIED

Size of school	Number of full-time non-certified math teachers	Avg. no. of full-time non-certified math teachers	Percent of full-time non-certified math teachers	Number of part-time non-certified math teachers	Avg. no. of part-time non-certified math teachers	Percent of part-time non-certified math teachers
Under 100	4	0.67	33.3	2	0.33	100.0
100-299	15	0.58	24.2	7.5	0.29	27.8
300-499	4	0.12	4.3	17	0.50	43.6
500-1000	9	0.23	4.5	20.5	0.53	46.1
over 1000	0	0.00	0.0	2	0.20	22.2
TOTAL	32	0.28	7.0	49	0.43	40.3

consideration, we see that in schools with fewer than 300 students, 25.7% of the full-time mathematics teachers, and 27.7% of all mathematics teachers, are non-certified. In schools with 300 or more students, only 3.4% of the full-time mathematics teachers, and 9.2% of all mathematics teachers, are non-certified. The smaller the school, the greater the percentage of non-certified mathematics teachers. It seems safe to say that smaller schools have difficulty hiring qualified (i.e., certified) full-time mathematics teachers. When part-time mathematics teachers are considered, we see that about 40% of them are not certified. Overall, 14% of the mathematics teachers, both full- and part-time, are not certified. Thus, while Table 4 seemed to indicate that the smallest schools do not need to rely on part-time teachers, the data presented in Table 5 seem to indicate that many of these teachers, both full- and part-time, need better preparation in mathematics education.

At the time this survey was conducted, the State of Maine had the following mathematics requirements for being certified as a secondary school mathematics teacher:

1. Graduation from a four-year baccaluareate program approved for the education of secondary school teachers, together with the formal recommendation of the preparing institutions; or
2. Preparation which includes the following:

   .
   .
   .

   c. Evidence of established teaching field(s) according to either of these patterns:

   Pattern A. One major teaching subject of at least thirty hours (which may include three hours of special methods) plus one minor teaching subject of at least eighteen hours or,

   Pattern B. A minimum of fifty hours (which may include three hours of special methods) in an area of specialization (i. e., ...mathematics)

Notice that is was possible to be certified to teach secondary school mathematics with an 18 semester hour minor in mathematics. Nothing was specified as to the content of these 18 hours. It would appear that any 18 hour group of mathematics courses would suffice.

These certification requirements were changed in May 1988 and now read as follows:

A. Graduation from an accredited baccaluareate program approved for the education of math teachers with a major in mathematics together with the formal recommendation of the preparing institutions

OR

B. Preparation which includes:

.
.
.

a. A minimum of 36 semester hours in the following:
   (1) Modern abstract algebra
   (2) Geometry
   (3) Calculus
   (4) Probability and statistics
   (5) Foundations and history of mathematics
   (6) Computer application which includes an introduction to computer programming
   (7) Discrete mathematics

In addition to the above mathematics requirements, the professional education requirements include content area methods. No mention is made of certification being granted in academic minor areas of study. Since these 36 semester hours do not include a content methods course, this is an increase of nine semester hours over the mathematics major in the previous requirements. Since it appears as if one cannot be certified in a minor area, these new requirements not only double the number of semester hours needed to be certified, but specifies areas in which these courses must be taken. As will be seen later, one of these areas, discrete mathematics, only 6.5% of the teachers who responded to the survey reported that they had an undergraduate course in discrete mathematics.

Mathematics and Computer Facilities

The next several tables illustrate the extent of some of the mathematics and computer facilities in Maine's secondary schools.

Table 6 presents the analysis of question 9: "Is there a specially equipped classroom in your school that is used as a 'math lab?'" Few schools in Maine have what they consider a math lab. Only 11 (9.6%) of the responding schools had a math lab and they devoted a total of 15 rooms to these laboratories. (There is no one definition of a math lab. Some schools consider it a place where students get, and often use, math oriented activities and materials. Other schools consider a math lab a place where students go to get help with mathematics. This help may be from a teacher or student.)

Table 6

TOTAL AND PERCENT OF SCHOOLS WITH A MATHEMATICS LABORATORY

Size of school	No. of schools with a math lab	% of total schools with math lab	% of schools this size with math lab
Under 100	1	0.9	16.7
100-299	4	3.5	15.4
300-499	3	2.6	8.8
500-1000	2	1.7	5.1
over 1000	1	0.9	10.0
TOTAL	11	9.6	

On the other hand, as can be seen in Table 7, 109 (94.8%) of the schools have a computer lab. The computer labs occupied an average of 1.8 rooms. One might suspect some schools to have converted their math labs to computer labs. Examination of the raw data reveals that each of the 11 schools that had a math lab also had a computer lab. Thus, while some math labs might have been converted to computer labs, no schools had a math lab instead of a computer lab.

Next, we examined the locations of the microcomputers and the types of software that the

Table 7

TOTAL AND PERCENT OF SCHOOLS WITH A COMPUTER LABORATORY

Size of school	No. of schools with a computer lab	% of total schools with computer lab	No. of rooms	Avg. no. of rooms
Under 100	5	4.3	4.0	0.8
100-299	24	20.9	28.0	1.2
300-499	31	27.0	76.0	2.5
500-1000	39	33.9	67.0	1.7
over 1000	10	8.7	24.0	2.4
TOTAL	109	94.8	199.0	1.8

schools used. Table 8 shows that Maine's secondary schools have an average of 31.68 microcomputers per school. The number of microcomputers is in direct relationship to the size of the school. The majority (63.1%) of microcomputers are located in the microcomputer labs. The next most frequent location (16.1%) is in a classroom. The remaining microcomputers are in offices or are portable and rotate from one location to another as they are needed.

Schools were asked to indicate the types of computer software that were available in the

Table 8

TOTAL AND AVERAGE NUMBER OF MICROCOMPUTERS SORTED BY SIZE OF SCHOOL AND LOCATION OF MICROCOMPUTER

Size of school	Total number of micros	Avg. no. of total micros	Number of lab micros	Avg. no. of lab micros	Number of office micros	Avg. no. of office micros	Number of rotating micros	Avg. no. of rotating micros	Number of classroom micros	Avg. no. of classroom micros
Under 100	41	8.20	23	4.60	2	0.40	1	0.20	12	2.40
100-299	475	19.79	285	11.88	52	2.17	33	1.38	82	3.42
300-499	919	29.65	551	17.77	91	2.94	43	1.39	149	4.81
500-1000	1445	37.05	895	22.95	128	3.28	96	2.46	274	7.03
over 1000	573	57.30	424	42.40	40	4.00	35	3.50	38	3.80
TOTAL	3453	31.68	2178	19.98	313	2.87	208	1.91	555	5.09

school. With one exception, there was not a large variety. The exception, computer assisted instruction (CAI) software, was in only 11.3% of schools. This can be contrasted with the fact that almost every school (93.9%) had a word processing program for student use. [In fact, more schools had word processing programs for students than had them for office staff (85.2%).] With the exception of CAI programs, the types of programs ranged from the high of 93.9% for word processing software to a low of 63.5% for tutorial-type computer programs.

Table 9

TYPE OF COMPUTER SOFTWARE AVAILABLE IN SCHOOL
SORTED BY SIZE OF SCHOOL

Size of school	Word processing for staff	Word processing for students	Spread sheets	Database	Drill & Practice	Tutorials	CAI	Programming languages
Under 100	4	6	1	1	5	5	1	5
100-299	23	25	18	17	23	15	0	18
300-499	25	30	23	26	27	19	4	21
500-1000	38	37	35	32	32	26	4	22
over 1000	8	10	8	10	9	8	4	8
TOTAL	98	108	85	86	96	73	13	74

Professionalism

One way that educators remain current is to read the professional journals in their field. There are two common ways to obtain journals. One is to belong to a professional organization. A privilege of membership in such an organization is a subscription to the journals(s) of that organization. A second way to obtain professional journals is for the school to subscribe and for teachers to have journals available through the school's library or in the teachers' lounge. Table 10 shows the journals to which each school subscribes. Three of the four journals most frequently subscribed to are the NCTM publications: *Mathematics Teacher* (44.2%), *Arithmetic*

Table 10

SCHOOL SUBSCRIPTIONS TO
PROFESSIONAL MATHEMATICS EDUCATION JOURNALS
SORTED BY SIZE OF SCHOOL

Size of school	AT*	JRME	MT	SSM	MMo	CMJ	MMag	ATMNEJ	None
Under 100	0	0	2	0	0	0	0	0	4
100-299	2	3	10	3	2	3	0	5	12
300-499	2	2	12	4	0	1	0	8	15
500-1000	7	5	23	0	3	1	4	9	12
over 1000	2	0	5	0	0	0	0	3	4
TOTAL	13	10	52	7	5	5	4	25	47

*AT = Arithmetic Teacher
MT = Mathematics Teacher
MMo = Mathematics Monthly
MMag = Mathematics Magazine
JRME = Journal for Research in Mathematics Education
SSM = School Science and Mathematics
CMJ = College Mathematics Journal
ATMNEJ = Assoc. of Teachers of Mathematics in New England Journal

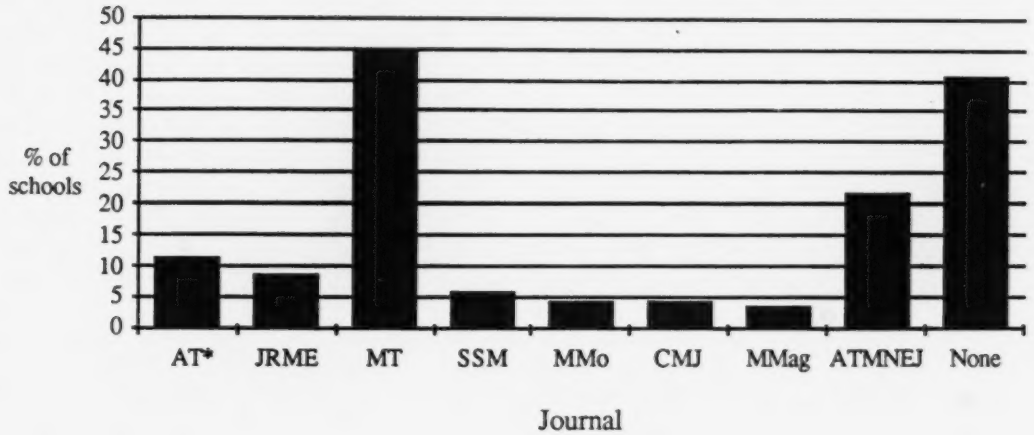
Teacher (11.3%) and the *Journal for Research in Mathematics Education* (8.7%). The other journal in the top four was that of the Association of Teachers of Mathematics in New England (ATOMNE). This journal is a benefit of membership in Maine's state organization for mathematics teachers, the Association of Teachers of Mathematics in Maine (ATOMIM) since part of the money for a membership in ATOMIM is used for a membership in ATOMNE. Over 40% (40.8%) of the schools did not subscribe to any of these journals.

The percentage distribution of subscriptions is shown graphically in Figure 2. If the data in Table 10 are examined, there does not seem to be any discernable pattern as to the size of the school and the fact that the school did not subscribe to any of these eight journals. (Statistics regarding which professional journals are read by mathematics teachers will be examined in the discussion of the Teacher's Survey.)

Two remaining pieces of data were compiled from the Principal's Survey. The first concerned the number of mathematics teachers who belong to a professional mathematics organization. The second concerned the extent to which principals encouraged their mathematics

Figure 2

PERCENT OF SCHOOLS SUBSCRIBING TO PROFESSIONAL MATHEMATICS JOURNALS



*AT = Arithmetic Teacher
MT = Mathematics Teacher
MMo = Mathematics Monthly
MMag = Mathematics Magazine
JRME = Journal for Research in Mathematics Education
SSM = School Science and Mathematics
CMJ = College Mathematics Journal
ATMNEJ = Assoc. of Teachers of Mathematics in New England Journal

teachers to take further professional development activities and/or to pursue a graduate degree.

Table 11 contains data from the principals on the number of the mathematics teachers who belong to professional mathematics organizations. According to the principals, only 179 of their mathematics teachers belong to such organizations. This represents 39.3% of their full-time mathematics teachers. If the part-time teachers are included, then only 31.0% of the mathematics teachers in Maine belong to a professional mathematics organization. One might argue that this is not a true reflection of the number of teachers who belong to professional organizations, since many principals may not have this statistic available. However, as shall be seen during the discussion of the Teacher's Survey, this is a fairly representative measure of this aspect of professional involvement of mathematics teachers.

It is interesting to note that the smallest percentages of full-time mathematics teachers who belong to professional mathematics organizations are from the smallest (under 100 students) and

Table 11

TOTAL, AVERAGE AND PERCENT OF TEACHERS THAT BELONG TO A PROFESSIONAL MATHEMATICS ORGANIZATION

Size of school	Total no. members of professional math. orgs	Avg. no. members of professional math. orgs per school	Percent of math teachers who are members of professional math orgs	
			Full-time	Total
Under 100	2	0.33	16.7	14.3
100-299	28	1.08	45.2	31.5
300-499	50	1.47	53.2	37.6
400-1000	86	2.21	43.4	35.5
over 1000	13	1.30	14.6	13.4
TOTAL	179	1.56	39.3	31.0

the largest (over 1000 students) schools.

Question 13 on the Principal's Survey asked "In what ways, if any, do you encourage teachers on your staff to join mathematics education professional organizations?" A total of 73 written responses were received from 63 (54.8%) of the respondents. Most types of encouragement were monetary in nature with about 25 principals indicating that the school will pay for memberships in professional organizations. Generally the money was for an institutional membership or for an individual membership for the department head. For example, one principal said "The district will pay 60% of their [teachers'] professional dues; also we support their requests for professional leave and encourage all staff to keep up with state of the art in all curriculum areas." However, one principal specifically said that "The school will NOT pay the dues." Ten principals were willing to pay for teachers to attend a mathematics meeting and five said that they approve requests to attend meetings, workshops, visitations, etc. They did not indicate if any financial support was provided or if the teachers were expected to pay all expenses to attend these functions. Two principals indicated that they believe teachers have a professional obligation to belong to professional organizations. As one principal stated, "It is expected that they will be deeply involved in their chosen field and will grow and develop their skills to aid our

students." A complete list of principal's responses to this question is in Appendix B.

Table 12 shows that about 96.3% of principals believe that they encourage their mathematics teachers to pursue professional development activities and/or a graduate degree. The ways in which this is done vary. Some principals listed more than one means of encouraging their teachers.

Table 12

NUMBER OF PRINCIPALS WHO ENCOURAGE THEIR MATHEMATICS TEACHERS TO TAKE ADDITIONAL PROFESSIONAL WORK

	Yes	No	Maybe
Professional development activities	106	3	1
Pursue a graduate degree	104	4	0

Money was the primary means that principals use to encourage professional development activities. In fact, 40 principals indicated that the school paid for such items as tuition, textbooks, time support, conference expenses or substitutes. Another 29 encouraged their staff members to attend conferences and meetings. Closely related to that were the 18 principals whose encouragement was in the form of inservice workshops, courses and staff development activities. Twelve principals said that this encouragement came in the form of granting professional days or released time. Several principals used more indirect means such as circulating information and literature that might be of interest to their teachers.

Some comments were quite specific. For example, one principal said that "Each year the whole department attends [the] NCTM conference." Another stated that "One day per year is required contractually for professional growth in their area. (Beyond regular workshop days.)." Other principals were more nebulous with such comments as: "I support them in their goals."

and "I use strong verbal encouragement." Appendix B contains the complete list of principal's responses to Question 14: "In what ways, if any, do you encourage teachers on your staff to participate in continuing professional development activities related to mathematics teaching?".

Types of encouragement for pursuing a graduate degree were more specific and easier to classify than were those for participating in professional development activities. Tuition reimbursement or other budgetary support was provided by 39 schools. Another 13 provided time off or professional leave. A few schools indicated that this was done through inservice workshops or courses offered locally. For six principals, the encouragement was the pay differential in the salary schedule. Three principals said that their encouragement was given as part of the evaluation process.

Specific comments by principals included one who said that "Provisions in the collective bargaining agreement for sabbatical leaves (full pay for half year or half pay for full year)." Along this same line was the principal who stated "We pay $^1/_2$ the tuition and 100% of the textbook costs for teachers taking advanced classes in their discipline." Another principal avowed that "Teachers must see a direct benefit for them in the classroom. In short, how will pursuing a masters make them better high school math teachers." A more direct suggestion was that teachers "... make their needs known to the University." Another principal stated that encouragement was in the form of written references. Two principals said that all their mathematics teachers had graduate degrees. Another, who was not quite as fortunate, stated "Two-thirds of the mathematics department have graduate degrees. The others are offered money and time to achieve degrees." Appendix B contains the complete list of principal's responses to Question 15: "How do you encourage the mathematics teachers on your staff to pursue a graduate degree in mathematics education?".

Again, during discussion of the Teacher's Survey, some interesting comparative statistics will show that many teachers do not perceive that their administrators are encouraging them to pursue advanced degrees or to become involved in professional development activities.

Improving Secondary School Mathematics Programs

The last question on the Principals Survey asked the following question: "In what areas do you think there is a need to improve the mathematics program in your school?" A total of 139 responses were received from 91 (79.1%) of the respondents. Some principals listed more than one area to improve. The problems that principals identified can be grouped into the major categories of curriculum development, staff development, equipment and materials, coordination and applications. We will look briefly at each of these categories. Complete responses are contained in Appendix B. Later, in Section V, we shall see how teachers responded to this same question and will look for some commonalities and differences between the two groups.

The first of the major categories identified by principals was curriculum development. The largest number of comments, 19, dealt with the opinion that something should be done for lower ability students. Most of these comments concerned "basic skills" and vocational or general mathematics. For example, one principal said that the there was a need to improve the "basic understanding of math by vocational students." Another said that we needed to pay "more attention to general students and low achievers" and a third expressed this as a "need to address needs of non–college bound." Low achievers have long been a problem for mathematics programs. The frustration with our inability to cope with this problem was captured by the principal who said, "By doing more for the lower level student—what I don't know. I feel we are not reaching the very low student." Perhaps the biggest problem was identified by the principal who said that we need "to increase teacher awareness and skills in the teaching of unmotivated students and gifted underachievers."

A dozen principals commented on the need for additional courses beyond Algebra II. There did not seem to any consensus as to the nature of the course. Those mentioned were statistics, discrete math, precalculus, calculus and advanced placement calculus.

The first recommendation in *An Agenda for Action: Recommendations for School Mathematics of the 1980s* (NCTM, 1980) was that "problem solving be the focus of school

mathematics in the 1980s." Ten principals identified problem solving as an area where their schools needed to improve the mathematics program. One principal wrote that the real need was to focus the mathematics program. This principal expanded on this by saying "It is becoming ever less important to spend twelve years of a student's math education teaching him/her to resolve equations and formulae. Learning how to develop algorithms to solve real problems is a much more meaningful focus."

As might be expected, calculators and computers received a great deal of attention. There were ten comments on calculators and computers. While a few indicated that they should be used for individual drill and practice, most wanted their mathematics program to "integrate calculators and computers into the curriculum."

Other curricular comments dealt with improving or changing the algebra courses, teaching gifted and talented students (one principal wanted more and another thought there was too much emphasis on this area), middle school mathematics and graduation requirement.

The next major area where principals thought their school's mathematics program needed to be improved was in staff development and staffing. Eight principals commented on staffing needs. For example, one principal said "It is becoming increasingly more difficult to hire good mathematics teachers, without which our programs will definitely suffer." Another stated that "we need more teachers able to teach higher–level math."

As the last statement indicated, the preparation of teachers is a major concern. Thus, while eight principals commented on staffing needs, three times that number commented on teacher training. Some comments were in the realm of self-improvement. Typical of these was this comment: "In–service opportunities for the improvement of math instruction need to be expanded." Another said: "Get all teachers to attend NCTM National and regional conferences."

But, even more than self–improvement activities, principals wanted improvement in the preparation of present and future teachers. Two of the more vague comments were: "Need broader and stronger backgrounds for some teachers" and "Younger teachers need more

courses."

The next four comments not only provide more detail, but they provide insight into some areas where principals believe universities need to bolster their teacher preparation programs—not just the programs preparing teachers of mathematics. These four principals said that their school's mathematics program needed improvement in the following:

- "A real understanding of how kids learn and what they need. Help for teachers on how to deal with multi-levels in [the] classroom."
- "Teachers need more training regarding methods, content, and motivation of students in low or low-middle levels of learning."
- "Teachers need to know more about their own learning and teaching styles."
- "To learn the principles of learning in teaching and be able to apply this to teaching math in the classroom."

Eight principals commented on coordination. Comments generally concerned the need to improve communication and coordination among members of the mathematics department, with other department, and with the other schools in the district. Some simply said that they needed to improve "K–12 coordination." One principal, who possibly said it best, commented that "we need to provide greater opportunity for our high school math teachers to meet and dialogue with the math teachers at other grade levels and in other places."

Six principals commented on the need to improve textbooks or the school's facilities.

Five principals referred to the need for better testing programs or for more involvement with mathematics league competitions. Career opportunities and applications of mathematics were alluded to by seven principals. One commented on the need for "career education to show the need for advanced math" while another said teachers should "Make it more practical (show how/when it is used in the real world.)"

* * * * *

In this section, the results of the Principal's Survey have been examined. The next section will begin the examination of the Teacher's Survey. Some questions, such as which journals the teachers read, the professional organizations to which they belong, and the encouragement they are given by their administrators, relate to questions asked the principals. Other questions look at the undergraduate mathematics courses they took, whether they took a mathematics teaching methods course, or whether they had a practicum. In all cases, questions are examined either according to the sizes of the schools and/or whether teachers were or were not certified.

IV. Teacher's Survey

The analysis of the Teacher's Survey will look at the experience, training, certification, and professionalism of Maine's secondary school mathematics teachers. The discussion of the Survey will conclude with a look at some lists of graduate courses desired by these teachers and the locations to which teachers are willing to travel for these courses.

Experience

The ages of Maine's secondary school mathematics teachers is shown in Table 13. This table shows the number and percent of the 431 mathematics teachers in each of the five age categories. Note that 77.7% were 35 years old or more, while less that 2% were under 25 years of age.

National statistics from the *Digest of Education Statistics* (Snyder, 1987) are not as recent as those in this survey, so they are cited with some trepidation. The following data are for all elementary and secondary school teachers. The median age in 1983 was 39 and the median years of teaching experience was 12. It would appear as if Maine's secondary school mathematics teachers are older then the "average" teacher in the United States.

Another statistic in Table 13 is the sex of the mathematics teachers. As can be seen, approximately 67.9% of Maine's secondary school mathematics teachers are men. [National statistics, for all teachers regardless of level or subject taught, show that 32.8% of teachers are men.] When the sex of the mathematics teachers is listed by age category, it can be seen that the

percent of male secondary school mathematics teachers increases with each age category and, in fact, there is a startling jump in the percentage of male mathematics teachers over the age of 35. Several factors might contribute to this phenomenon. Among the simplest is the fact that few women who are now over 35 years old pursued a career in mathematics teaching when they were in school. Another possible reason is that women in this age category were from an era when it was considered more appropriate for women to quit teaching while they were raising a family. However, determining possible causes for this statistic are beyond the scope of this study.

Table 13

NUMBER, PERCENT AND SEX OF MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS GROUPED ACCORDING TO AGE

Age	Number	Percent	Number of Males	Number of Females	% Males
Under 25	8	1.9	2	6	25.0
25–34	88	20.4	43	45	48.9
35–44	199	46.2	141	58	70.9
45–54	115	26.7	90	25	78.3
55 and over	21	4.9	16	4	80.0
TOTAL	431	100.0	292	138	67.9

We next look to see how many years these teachers have been in education. Table 14 shows the number and percent of Maine's secondary school mathematics teachers according to the number of years they have worked in the field of education. As expected from the age of the teachers as shown in Table 13, 70.1% of these teachers have worked in education for 11 or more years. However, not all of that time has been spent teaching mathematics. While 70.2% of the teachers have worked in education 11 or more years, only 62.0% have spent 11 or more years teaching mathematics, and 51.8% have been in their present school for 11 or more years.

Table 14

NUMBER AND PERCENT OF MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS GROUPED ACCORDING TO YEARS IN EDUCATION, YEARS TEACHING MATHEMATICS AND YEARS AT PRESENT SCHOOL

	Years in Education		Years Teaching Math		Years at Present School	
Years	Number	Percent	Number	Percent	Number	Percent
Under 2	9	2.1	12	2.8	33	7.7
2–5	55	12.8	72	16.7	114	26.5
6–10	65	15.1	80	18.6	61	14.2
11–20	166	38.5	157	36.5	148	34.4
21–30	127	29.5	103	24.0	72	16.7
over 30	9	2.1	6	1.4	2	0.5
	431	100.2	430	100.0	430	100.0

Table 15 shows the number and percents of Maine's secondary school mathematics teachers grouped according to the grade level of their current teaching assignment. It is from this statistic that we are able to conclude that some of the data may be skewed. Every student has to take mathematics in grades 6, 7 and 8. Yet, only 24.6% of the teachers who returned the survey had assignments in schools that contain these grades. Unfortunately, the survey was apparently

Table 15

NUMBER AND PERCENT OF MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS GROUPED ACCORDING TO YEARS IN CURRENT TEACHING ASSIGNMENT

Grades	Number	Percent
K–3	0	0.0
4–6	3	0.7
5–8	16	3.7
7–9	53	12.4
7–12	34	7.9
9–12	174	40.6
10–12	149	34.7
TOTAL	429	100.0

not mailed to mathematics teachers in K-8 schools.

Table 16 shows the number of mathematics *classes* taught by the respondents. A list of 12 specific courses and two unspecified courses were provided for the respondents to indicate the number of classes they taught. A total of 1245 mathematics classes and 138 non-math classes were taught. Of the mathematics classes about 255 or 20.5% were for grades 7 and 8. (Some of the "other mathematics" such as Algebra Prep, Prealgebra, Grade 6, and Gifted/Talented were

Table 16

NUMBER OF MATHEMATICS CLASSES TAUGHT BY MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS GROUPED BY SIZE OF SCHOOL AND WHETHER TEACHER IS CERTIFIED

Size of school	Gr 7	Gr 8	Alg I	Alg II	Geom	Precalc	Analysis	Adv Calc	Calculus	Career math	General math	Shop math	Other math*	Non math
Under 100	4	2	2	8	7	6	1	0	3	1	5	0	4	3
100–299	14	10	9	37	30	23	10	1	14	4	22	0	9	13
300–499	38	8	11	61	49	47	17	3	17	8	31	2	12	39
500–1000	83	4	8	95	91	78	22	3	37	16	45	9	15	60
over 1000	36	0	1	40	32	41	10	2	9	4	29	1	4	23
TOTAL	175	24	31	241	209	195	60	9	80	33	132	12	44	138
teacher														
certified	157	21	28	213	192	183	56	9	76	30	115	11	38	118
non-cert.	11	2	3	21	12	11	2	0	2	3	11	0	5	14

*Other math courses taught (numbers in parentheses indicate no. taught if greater than 1)

Advanced algebra	Basic math	Finite math (2)	Problem solving
Algebra 1/2	Business math (11)	General algebra (2)	Remedial math (2)
Algebra I, Part II	College algebra and trig	General geometry	Review math
Algebra IA (3)	College review math (2)	General math 9	Senior math (Algebra III)
Algebra IB (3)	Computer literacy (13)	General math II	Senior reviewmath
Algebra prep	Computer math	Gifted/talented math (5)	Statistics (2)
Alternative education	Computer programming (49)	Grade 6 (5)	Trigonometry (9)
AP Computer science	Computer science (14)	Industrial/vocational math	Trigonometry (honors)
Applied math (2)	Consumer math (10)	Math tutorial program	Two-year algebra I
Basic algebra (2)	Elementary algebra I (7)	Prealgebra (45)	Vocational math
Basic geometry	Elementary algebra II (3)	Probabiltiy and statistics	

added to the Grade 7 and 8 totals.)

Table 16 also contains the number of certified and non-certified teachers that were responsible for each class. One might assume that non-certified teacher would be responsible for the lower level courses. We can see, however, that 48 of the 83 classes (or 57.8%) taught by the non-certified teachers were what might be classified as advanced classes (Algebra II, Geometry, Precalculus, Analysis and Calculus).

Training and Certification

So far, we have examined the experience of Maine's secondary school mathematics teachers. In the discussion of Maine's secondary school mathematics teachers, we broached the subject of non-certified teachers. We now discuss the training and certification of Maine's mathematics teachers..

Table 17 indicates the degrees held by the secondary school mathematics teachers in Maine. Only 72.6% of these teachers had either a mathematics major or minor when they completed their bachelor's degree. Furthermore, only 21.7% of mathematics teachers with a master's degree had either a mathematics major or minor in their graduate work.

Interpreting Table 17 another way, we see that 27.4% of Maine's secondary school

Table 17

NUMBER AND PERCENT
OF MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS
GROUPED ACCORDING TO DEGREE RECEIVED

Degree	Math major	Other major	Math minor	Avg. Year Degree Rec.	Percent with Math major	Percent with Math minor
BA*	254	159	58	1969.7	59.1	13.5
MA*	73	118	20	1973.4	17.0	4.7
CAS	5	9	1	1978.8	1.2	0.2
Doctoral	0	1	0	1967	0	0

* 12 teachers reported data for a master's degree but not for a bachelor's degree.

mathematics teachers who have bachelor's degrees did not have either a mathematics major or minor when they received that degree. Earlier, in Table 5, we saw that, according to the principals, 7% of the full-time and 14% of all secondary school mathematics teachers are not certified by the state to teach mathematics. Of the 101 teachers who did not have either a mathematics major or minor when they completed their bachelor's degree, 45 have received a master's degree, 12 with a major in mathematics and four with a minor. Thus, there are 29 mathematics teachers (6.7%) who completed the survey and who have both a bachelor's and a master's degree and did not have a mathematics major or minor for either degree. Of these 29 teachers, 12 have taken an average of 22 semester hours of course work since they finished their last degree—none of that course work was in mathematics. An additional eight have not taken any course work since they completed their last degree. Yet, 17 of these 29 indicated that they are certified to teach mathematics in the State of Maine. One wonders about the academic majors and minors of these teachers when they were attending college or university.

Table 18 shows the number of mathematics teachers who have each degree level, the

Table 18

NUMBER OF CERTIFIED AND NON-CERTIFIED
SECONDARY SCHOOL MATHEMATICS TEACHERS IN MAINE
SORTED BY DEGREE AND MAJOR

		Certified				Not Certified			
Degree	Total	No.	Math major	Other major	Math minor	No.	Math major	Other major	Math minor
<BA	4	2	0	2	0	1	0	1	0
BA	414	361	250	116	55	39	5	35	2
MA	195	170	67	106	22	15	4	12	1
CAS	15	15	5	11	1	0	0	0	0
Doctorate	1	0	0	0	0	1	0	1	0
Total		376				41			

number at each degree level who have state certification and whether those who are certified had either a mathematics major or minor. As can be seen, 90.3% of the secondary school mathematics teachers with bachelor's degrees reported that they are certified by the state. We can also see that 82.5% of those with bachelor's degrees and who are not certified did not have a mathematics major or minor.

Looking again a Table 18 for analogous data on those teachers with master's degrees, we find that 87.2% of the secondary school mathematics teachers with master's degrees reported that they are certified by the state. We can also see that 66.7% of those with master's degrees and who are not certified did not have a mathematics major or minor.

Some have recently argued that state certification regulations keep many qualified people from the teaching profession. The argument is that these people have the academic qualifications but are not certified because they lack the requisite education courses. As the data in Table 18 indicate, this is not the case for Maine's non-certified mathematics teachers. The requirements cited earlier (pp. 13-14) show that neither a mathematics major nor minor were required to be a certified secondary school mathematics teacher in Maine. The new requirements indicate that this is no longer the case.

The undergraduate courses taken by Maine's secondary school mathematics teachers are listed in Table 19. As one would probably expect, the most prevalent course was Calculus, followed by Linear Algebra. The next three most frequently taken courses were Statistics; Analytic Geometry; and Logic, Sets and Foundations. Notice that only 28 (6.5%) indicated an undergraduate course in Discrete Mathematics. This will be noted again in the discussion of Table 25.

The next table, Table 20, looks at the professional education preparation of the secondary school mathematics teachers in Maine. A total of 273 (65.5%) indicated that they have had a mathematics teaching methods course. Of that number, 261 (95.6%) are certified teachers of mathematics and 12 (4.4%) are non-certified.

Table 19

UNDERGRADUATE MATHEMATICS COURSES TAKEN BY MAINE'S CERTIFIED AND NON-CERTIFIED SECONDARY SCHOOL MATHEMATICS TEACHERS

	Calc.	Adv. calculus	Real analysis	Diff. equations	Linear algebra	Modern algebra	Analytic geom.	Euclid. geom.	Other than Euclid. geom.
Certified	349	206	79	195	262	208	229	168	117
Non–Certified	19	8	3	3	20	12	7	5	2
TOTAL	368	214	82	198	282	220	236	173	119

	Prob.	Stat.	Prob. and statistics (combined)	Combina-torics	Number theory	Discrete math	Computer literacy	Computer prog.	Hist. of math	Logic, sets & found.
Certified	168	225	158	25	211	28	76	177	194	222
Non–Certified	10	16	11	1	8	0	5	9	6	10
TOTAL	178	241	169	26	219	28	81	186	200	232

The data for student teaching or practicum are not much better. Here 292 (70.0%) had a practicum and it lasted an average (mean) length of 11.9 weeks. When these teachers are divided into those who are certified and those who are not, we see that 279 (74.2%) of the certified

Table 20

NUMBER OF MAINE'S CERTIFIED AND NON-CERTIFIED SECONDARY SCHOOL MATHEMATICS TEACHERS WHO HAD A MATHEMATICS TEACHING METHODS COURSE AND/OR WHO HAD A PRACTICUM (STUDENT TEACHING)

	Math. teaching methods	Had Practicum	Weeks of Practicum Total	Weeks of Practicum Mean
Certified	261	279	3299	11.8
Non–Certified	12	13	177	13.6
TOTAL	273	292	3476	11.9

teachers had a practicum that lasted an average of 11.8 weeks. Only 13 (31.7%) of the non-certified teachers have had a practicum. Their practicum averaged 13.6 weeks in length, almost two weeks longer than that of the certified teachers. [Note: Many teachers indicated their practicum lasted "one semester" or "$^1/_2$ semester." The length of a semester varies from one school to another. In each case, a figure of 16 weeks was used. As a result, the figures for the mean length of a practicum may be slightly longer than it should be.]

Continuing with a look at certified teachers, Table 21 contains data on the number and percent of teachers who are certified and/or who have taken college or university courses since their highest degree. The data are sorted according to the size of the teachers' schools in order to allow these data

Table 21

NUMBER OF CERTIFIED AND NON-CERTIFIED TEACHERS, THOSE WHO HAVE TAKEN GRADUATE COURSE WORK, THE NUMBER AND AVERAGE HOURS COMPLETED, AND WHETHER THEY ARE ENCOURAGED TO PURSUE PROFESSIONAL DEVELOPMENT ACTIVITES GROUPED BY SIZE OF SCHOOL

Size of school	Certified?		Taken courses?		Hours completed		Encouraged by principal?		
	Yes	No	Yes	No	Total	Mean	Yes	No	% Yes
Under 100	10	1	9	2	109	12.1	7	3	70.0
100–299	44	16	59	6	1269	21.5	31	27	53.4
300–499	96	10	88	20	1725	19.6	73	27	73.0
500–1000	162	9	143	34	2576	18.0	105	63	62.5
over 1000	64	4	57	12	1069	18.8	45	20	69.2
TOTAL	376	40	356	74	6748	19.0	261	140	65.1

to be more easily compared with that in Table 5.

In Table 5, we saw that the principals reported that 27.7% of all secondary school mathematics teachers in schools with fewer than 300 students were not certified. In Table 21, it can be seen that 23.9% of the responding teachers in schools with fewer than 300 students were not certified. On the other hand, 7.1% of the teachers from schools with 300 or more students

stated that they did not have a state teaching certificate. Comparable data from the principals stated that 9.2% of mathematics teachers in schools with 300 or more students were not certified.

Table 21 contains some other interesting data. For example, 65.1% of the mathematics teachers reported that their administration encourages them to participate in continuing professional development activities related to mathematics teaching. Compare this to Table 12, where 96.3% of the principals reported that they encourage their teachers to pursue these profession development activities. Something appears to be missing when one sees such a large discrepancy in data. While principals believe that they are encouraging their teachers to improve themselves professionally, the teachers do not seem to be aware of this encouragement. Perhaps the principals are being too subtle!

Further analysis of the data used for Table 21 does not provide any appreciable difference according to gender as to whether a teacher reported being encouraged by his or her principal to pursue professional development activities. A total of 175 (64.6%) of the males and 86 (66.2%) of the females reported this encouragement.

The final part of Question 18 asked "How does your administration encourage you to participate in continuing professional development activities related to mathematics teaching?" This question was comparable to Question 14 on the Principal's Survey. As we just saw, almost 35% of the teachers answered the first part of Question 18 by checking "No." As a result, it is not surprising that only 231of the 433 respondents answered the second part of this question. A total of 91 responses were just one or two words: "Attend conferences," "Conferences", "Conventions," "Courses" and "Workshops." None of these indicated whether the school paid for any of these activities.

Another large category were funded activities. A total of 68 responses indicated some sort of reimbursement. For example, one teacher wrote that the "Administration encourages us to participate by reimbursing us for professional courses taken." Some teachers qualified their answers similar to the teacher who said "I am not sure how to answer. If money is available, I

can usually get approved for professional days to attend conferences. I have been refused at times because of lack of funds." It is too bad that more teacher's answers were not like the following. "They inform us of upcoming conferences, give us release time, and pay all expenses. They are members in the Southern Maine Partnership which has a math group meeting monthly. They are terrific (Superintendent and Principal)!!!"

In spite of this low-perceived level of encouragement, 82.4% of Maine's secondary school mathematics teachers have taken some college or university courses since they received their highest degree. But, only 18.5% reported that this work will apply toward the requirements for another degree. Of these, 44 said that the courses will apply toward a master's degree, 5 are applying it toward a Certificate of Advanced Study (CAS), and 6 toward a doctorate. The mean number of hours completed by these teachers who have taken additional work was 19.

The areas in which these teachers have taken graduate course work relate, for the most part, to their teaching areas. For example, 141 have taken some courses in mathematics or mathematics education and 103 have taken work in computer science or computer programming. The next largest areas were in education (67 responses), science (39), educational administration (22) and business (16). Some of the other areas in which courses were taken were real estate, art history, French, coaching (6), drivers education (5), English (5) and guidance and counseling (7). Courses were taken in about 30 different areas, including those mentioned above. Some teachers had taken courses in several areas.

The data in Table 21 are encouraging. But, in Table 22 we see that it has been 7 or more years since 42.3% of the teachers have taken a mathematics course or since 52.0% have taken a mathematics education course. This may not be surprising when the ages of these teachers is taken into consideration.

Professionalism

In the last section, we examined the principal's perceptions of the professionalism of their

Table 22

NUMBER OF YEARS SINCE
MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS
LAST COMPLETED A MATH OR MATH EDUCATION COURSE

	Math	Math education
0–3	131	100
4–6	93	59
7–9	55	33
10 or more	109	139
TOTAL	388	331

mathematics teachers. Next, we will examine the professionalism of Maine's secondary school mathematics teachers as reported by those teachers. This will focus primarily on the organizations to which these teachers belong and the professional mathematics education journals that they read.

One measure of professionalism is the willingness and effort to keep current in your professional field. One does this by taking university courses, through memberships in professional organizations and by reading professional journals.

In Table 23, we see the number and percent of Maine's secondary school mathematics teachers who belong to a professional organization. Most of them belong to one or more of the teachers' unions, the National Education Association, the American Federation of Teachers or the Maine Teachers Association. Only 26.7% belong to the National Council of Teachers of Mathematics. As stated previously, a membership in ATOMIM automatically results in a membership in ATOMNE. Yet, only 13.0% claimed to have membership in ATOMNE while 30.2% belonged to ATOMIM. The organizations listed in the "Other" category are listed below. The number of members is given when more than one person belonged to an organization.

American Association of Petroleum Geologists
American Association of Physics Teachers

Appendix B

Principal's Written Responses to Questions 13, 14, 15 and 16

American Association for the Advancement of Science	
Association for Supervision and Curriculum Development	4
Association for Computing Machinery	
Business Education Association of Maine	3
Convention of the American Instructors of the Deaf	
Council of Presidential Awardees in Math	
Delta Kappa Gamma	
Eastern Maine Math League	
Friends of Minerology	
International Council for Computers in Education	2
ITNMC	
Kappa Delta Pi Ed. Honor Society	
Local education association	11
Local Mathematics Association	2
M.A.P.S.E.	2
Maine Coaches Association	2
Maine Interscholastic Athletic Directors Association	
Maine Science Teachers Association	2
Maine Secondary School Principals' Association	3
Maine Trappers Association	
Math Association of America	
MCSS	
Montana Geological Association	
National Association of Secondary School Principals	3
National Association of Student Activity Advisers	
National Interscholastic Athletic Administrators Association	
National Science Teachers Association	6
NCSS	
NEACT	
New Hampshire Association Computer Educators	
Oregon Math Teachers Association	
Phi Delta Kappa	5
Professional Maine Guides Association	
Several Classics organizations	
Technology Education Association of Maine (TEAM)	
Women in Mathematics	
Wyoming Geological Association	

The data in Table 23 are consistent with the data in Table 11, in which we found that the principals stated that only 31% of their mathematics teachers belong to a professional mathematics organization. Since the principals were not asked to list the professional organizations to which their teachers belonged, this is the best comparison that can be made with these data.

Holtan's (1986) study of 669 of West Virginia's mathematics teachers found that 64.4% belonged the National Education Association, 67.6% to the West Virginia Education Association,

Table 23

NUMBER AND PERCENT
OF MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS
BELONGING TO SPECIFIC PROFESSIONAL ORGANIZATIONS

Organization	NEA*	AFT	MTA	SSMA	MAA	NCTM	ATOMIM	ATOMNE	Other	None
Number	301	11	250	0	17	115	130	56	70	59
Percent	69.7	2.6	57.9	0.0	3.9	26.7	30.2	13.0	16.2	13.7

*NEA = National Education Association
AFT = American Federation of Teachers
MTA = Maine Teachers Association
SSMA = School Science and Mathematics Association
MAA = Mathematics Association of America
NCTM = National Council of Teachers of Mathematics
ATOMIM = Assoc. of Teachers of Math in Maine
ATOMNE = Assoc. of Teachers of Math in New England

17.9% to the National Council of Teachers of Mathematics, 23.2% to the West Virginia Council of Teachers of Mathematics and 0.6% to the School Science and Mathematics Association. Comparing these to the data reported by Maine's mathematics teachers, one can see that a higher percentage of Maine's mathematics teachers belong to NCTM and to the state mathematics teachers association than do mathematics teachers in West Virginia.

Table 24 contains the number and percent of mathematics teachers who report that they read one or more of eight professional mathematics education journals listed on the survey. The most widely read journal is the *Mathematics Teacher*, read by 46.1% of the secondary school mathematics teachers in Maine. Next is its sister publication, the *Arithmetic Teacher*, read by 9.7% of the mathematics teachers. Unfortunately, some 42.6% of the teachers in survey reported that they read none of these professional journals. Almost twice as many mathematics teachers read the *Mathematics Teacher* as belong to NCTM. A benefit of membership in NCTM is a subscription to either the *Mathematics Teacher* or the *Arithmetic Teacher*.

Holtan's (1986) study of 659 of West Virginia's mathematics teachers found that 31.7% stated that they regularly read at least one article of the *Mathematics Teacher*, 20.5% read the *Arithmetic Teacher*, 2.5% read the *Journal for Research in Mathematics Education*, 4.2% read

Table 24

NUMBER AND PERCENT
OF MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS
WHO READ SPECIFIC PROFESSIONAL MATHEMATICS EDUCATION JOURNALS

Size of school	AT*	JRME	MT	SSM	MMo	CMJ	MMag	ATMNEJ	None
Under 100	1	0	2	1	1	0	0	0	8
100–299	4	1	25	1	2	0	1	1	32
300–499	14	3	51	2	3	0	2	9	42
500–1000	20	10	94	0	3	2	5	21	70
over 1000	3	2	27	0	0	1	1	3	32
TOTAL	42	16	199	4	9	3	9	34	184
Percent	9.7	3.7	46.1	0.9	2.1	0.7	2.1	7.9	42.6

*AT = Arithmetic Teacher
MT = Mathematics Teacher
MMo = Mathematics Monthly
MMag = Mathematics Magazine
JRME = Journal for Research in Mathematics Education
SSM = School Science and Mathematics
CMJ = College Mathematics Journal
ATMNEJ = Assoc. of Teachers of Mathematics in New England Journal

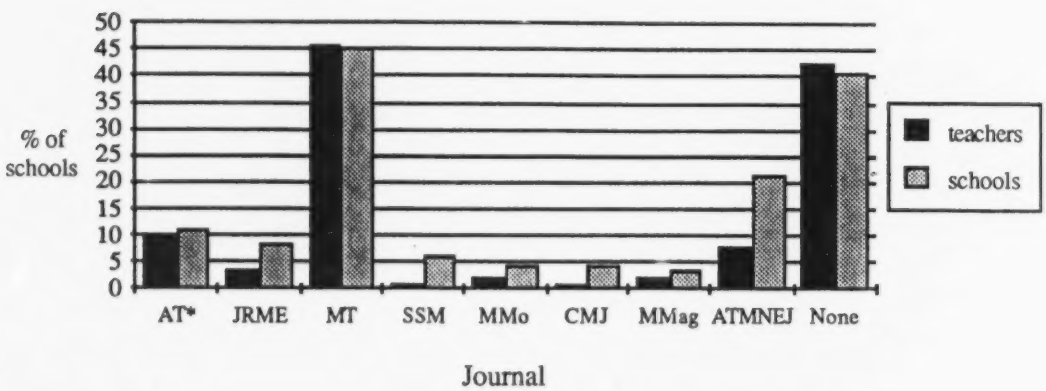
School Science and Mathematics and 1.8% read the Mathematics Association of America Journal. (Holtan did not specify which of the three MAA journals listed on the Maine survey were read by West Virginia's teachers.)

One interesting comparison is provided by looking at the data in Tables 10 and 22. This comparison can be seen graphically in Figure 3. Statistically, there is a correlation of $r = .902$ between the data in Tables 10 and 24. Thus, there is a very high correlation between the percent of schools that subscribe to professional mathematics education journals and the journals that are read by secondary school mathematics teachers. This correlation is very high and seems to indicate that "If the journals are there, they will be read." However, there is not sufficient data to infer this relationship. It is however, an interesting statistic.

* * * * *

Figure 3

PERCENT OF SCHOOLS SUBSCRIBING TO, AND TEACHERS READING, PROFESSIONAL MATHEMATICS JOURNALS



*AT = Arithmetic Teacher
MT = Mathematics Teacher
MMo = Mathematics Monthly
MMag = Mathematics Magazine
JRME = Journal for Research in Mathematics Education
SSM = School Science and Mathematics
CMJ = College Mathematics Journal
ATMNEJ = Assoc. of Teachers of Mathematics in New England Journal

In this section many of the quantitative data from the Teacher's Survey were examined. In the next section, the remainder of the data from this survey will be studied. In particular, this includes the results to the questions regarding which mathematics, mathematics education and general education courses these teachers would be interested in taking. In addition, these responses are examined to help determine which of eight locations teachers would be willing to travel to in order to take these courses, or if they would be interested in taking the course via interactive television. Of particular interest is the number of teachers who would be willing to work toward a master's degree in mathematics education at the University of Maine.

Finally, responses to the last three questions on the Teacher's Survey will be examined. The first two of these dealt with ways in which teachers think that mathematics education can be improved in Maine and in their school; the last question asked for any additional comments.

V. Desired Graduate Course Work and Ways to Improve Mathematics Education

Responses to questions 19 and 21 on the Teacher's Survey have been incorporated into Table 25, 26 and 27. Question 19 asked respondents to indicate the graduate level courses they would be interested in taking for credit. Respondents were to mark 6 or less from a list of 14 mathematics courses; 3 or less from a list of 10 mathematics education courses; and 2 or less from a list of 6 general education courses. Question 21 asked respondents to mark any of 8 locations to which they would be willing to travel in order to take a mathematics or mathematics education courses. Some respondents suggested the additional sites of Lewiston/Auburn and York. Figure 4 is a map of Maine showing each of these ten sites.

Mathematics Courses

Table 25 summarizes the responses to Questions 19 and 21 for mathematics courses. Eight of the courses were of interest to at least 80 people. The two most popular courses titles were History of Mathematics (113) and Probability (111).

Examination of Table 25 provides some variation among the preferred courses depending on the location where it might be offered. For example, Discrete Mathematics is ranked fourth in the total ranking. Yet, it is the second most preferred course of those who would go to Portland and last of those who would go to Machias. This table, and the next two should be valuable to people planning outreach programs for Maine's secondary school mathematics teachers.

Figure 4

Of the 14 mathematics courses listed in Table 25, the following six were among those listed by NCTM's PBETM Task Force in the September 1987 draft of their Guidelines (Dessart, 1987).

[12] Analysis for Teachers of Secondary School Mathematics

[8, 2] Statistics and Probability for Teachers of Secondary School Mathematics

[9, 10] Modern Geometries for Teachers of Secondary School Mathematics

[7] Topics in Algebra for Teachers of Secondary School Mathematics

[4] Discrete Mathematics

[3] Theory of Equations

Table 25

TOTAL NUMBER OF TEACHERS WANTING SPECIFIC MATHEMATICS COURSES AND LOCATIONS TO WHICH THEY ARE WILLING TO TRAVEL

Name of Mathematics Course	Number who want course	Augusta	Farmington	Ft. Kent	Machias	Oakland/ Waterville	Orono	Portland	Presque Isle
Algebra	83	23	16	2	4	22	24	29	3
Approximation Methods	59	15	4	3	3	10	18	24	4
Number Theory	89	23	12	6	2	12	31	40	10
Advanced Calculus	53	18	7	3	2	12	20	21	4
Probability	111	25	16	6	6	21	38	43	8
Statistics	80	19	11	5	3	13	21	37	6
Geometric Linear Algebra	84	20	9	5	4	11	30	33	7
Advanced Euclidean Geom	64	18	4	5	1	9	17	34	7
Non-Euclidean Geometry	68	20	9	2	2	11	25	31	2
Modern Analysis	57	12	5	4	2	4	17	24	6
Discrete Math	96	24	10	3	1	13	28	47	6
Theory of Equations	98	20	9	7	4	14	35	42	9
Numerical Analysis	57	14	7	7	4	8	14	27	6
History of Math	113	30	10	7	3	20	27	56	8
Other*	32								
Total number willing to travel to:		106	56	18	16	61	102	170	27

*Other courses listed by respondents (no. listing course if greater than 1):

Advanced coordinate geometry
Basic hands-on computer course
Business mathematics
Complex numbers
Computer applications of algebra
Computer science [PASCAL] (2)
Computers in education and mathematics teaching
Geometry (2)
Graph theory
Group process
Ideas for using computers in mathematics classes
Logic
Mathematics for everyday use
Networking, queueing theory, modeling optimazation, decision making, logical thought
Refresher courses in trigonometry and calculus (3)
Review of calculus, algebra, etc. (6)
Technical applied mathematics
Topology (3)
Trigonometry (2)

The survey did not contain the phrase "for Teachers of Secondary School Mathematics" in the titles of these courses. In addition, probability and statistics were listed as separate courses. The ranking of each of these courses is given in the bracket at the left of the course title.

The latest, (June 1988) version of PBETM's Guidelines (Dessart, 1988b) contains the following modified list of mathematics courses.

Analysis for Teachers of Secondary School Mathematics

Statistics and Probability for Teachers of Secondary School Mathematics

Modern Geometries for Teachers of Secondary School Mathematics

Topics in Algebra for Teachers of Secondary School Mathematics

Discrete Mathematics

History of Mathematics

It is interesting to note that the third ranked course by Maine's secondary school mathematics teachers, Theory of Equations, has been deleted and replaced by History of Mathematics, ranked first by the Maine teachers. The Maine teachers' fifth-highest ranked favorite course, Number Theory, is not on either of the Task Force's lists. Many students have taken either Number Theory or History of Mathematics as undergraduates. In fact, looking back at Table 19, we see that 219 (50.7%) indicated that they had a Number Theory course as undergraduates and 200 (46.3%) indicated that they had a course in History of Mathematics. However, only 28 had Discrete Mathematics, and it is ranked fourth on the list of desired courses. This is probably a reflection of the fact than many people are suggesting that discrete mathematics be included in the secondary school curriculum. It becomes the advisor's responsibility to insure that the graduate program closes any gaps in the undergraduate preparation.

Mathematics Education Courses

Table 26 summarized the responses to Questions 19 and 21 for the 10 mathematics education courses. The most frequently requested course is Problem Solving in Secondary School Mathematics. This was followed by Methods of Teaching Algebra in Secondary School Mathematics, Methods of Teaching Geometry in Secondary School Mathematics and Methods of

Table 26

TOTAL NUMBER OF TEACHERS WANTING SPECIFIC MATHEMATICS EDUCATION COURSES AND LOCATIONS TO WHICH THEY ARE WILLING TO TRAVEL

Name of Mathematics Education Course*	Number who want course	Augusta	Farmington	Ft. Kent	Machias	Oakland/ Waterville	Orono	Portland	Presque Isle
Problem Solving in SSM	230	60	26	10	9	37	59	97	17
Technology in SSM	74	19	8	2	2	9	17	35	5
Current Curriculum	80	24	13	2	0	12	24	38	5
Models of Teaching	94	23	13	8	3	14	29	41	13
Psychology of Teaching	58	24	10	2	2	11	12	31	3
Teaching Algebra in SSM	136	33	16	5	7	23	35	53	9
Teaching Geometry	107	30	12	7	4	15	25	46	9
Teaching Advanced Topics	99	28	10	2	3	14	31	43	3
Teaching Middle/Jr High	39	10	6	1	2	6	11	12	4
Diagnostics and Remed	58	18	8	2	2	13	13	31	5
Other*	10	0	0	0	0	0	2	3	0
Total number willing to travel to:		106	56	18	16	61	102	170	27

*Courses as listed on the survey were:
Problem Solving in Secondary School Mathematics
Technology in Secondary School Mathematics
Current Curriculum, Teaching, and Research Issues in Secondary School Mathematics
Models of Teaching and Instructional Strategies for Secondary School Mathematics
Psychology of Teaching Secondary School Mathematics
Methods of Teaching Algebra in Secondary School Mathematics
Methods of Teaching Geometry in Secondary School Mathematics
Methods of Teaching Advanced Topics in Secondary School Mathematics
Methods of Teaching Mathematics in Middle and Junior High Schools
Diagnostics and Remediation in Secondary School Mathematics

**Other courses listed by respondents (no. listing course if greater than 1):
Computer implementation in the mathematics curriculum/classroom (2)
Computers in secondary mathematics education
Integrated disciplines
Mathematics for the non-achiever
Mathematics in the middle school
Problem solving in the middle schools and junior high school (2)
Teaching algebra to 7th and 8th graders
Use of math manipulatives at the secondary school level

Teaching Advanced Topics in Secondary School Mathematics. One course, Methods of Teaching Mathematics in Middle Schools and Junior High Schools received a rather low ranking. But, this course, perhaps more than any other, may have suffered from the inadvertent exclusion

of the secondary school mathematics teachers in K-8 schools from the survey's mailing.

Of the ten mathematics education courses listed in Table 26, the following four were among those listed by NCTM's PBETM Task Force.

[1] Problem Solving in Secondary School Mathematics

[7] Technology in Secondary School Mathematics

[8] Psychology of Teaching Secondary School Mathematics

[5] Models of Teaching and Instructional Strategies for Secondary School Mathematics

[6] Current Curricular, Teaching, and Research Issues in Secondary School Mathematics

[8] Diagnostics and Remediation

The last course was put on the survey as "Diagnosis and Remediation in Secondary School Mathematics." The ranking of each of these courses by Maine's secondary school mathematics teachers is given in the bracket to the left of each course title.

The June 1988 revision of the Guidelines contains the following list of suggested mathematics education courses (p. 15)

Problem Solving in Secondary School Mathematics

Technology in Secondary School Mathematics

Psychology of Mathematics Learning

Current Curricular, Teaching, Teaching, and Research Issues in Secondary School Mathematics

Mathematics Instruction in Grades 7–12

Secondary School Mathematics Curriculum

Notice that the psychology course was listed as "Psychology of Mathematics Learning," a much more appropriate title than the title listed on the Teacher's Survey. The course title of "Models of Teaching and Instructional Strategies for Secondary School Mathematics" was changed in the January 1988 draft to "Mathematics Instruction in Grades 7–12." Another

course, "Diagnostics and Remediation is Secondary School Mathematics," was deleted and replaced by a course titled "Secondary School Mathematics Curriculum."

It would appear as if Maine's secondary school mathematics teachers are interested in solutions to problems in, and suggestions for teaching, specific subject areas in secondary school mathematics. This can be seen by the fact that the courses they ranked second, third and fourth (which deal with the teaching of algebra, geometry and advanced topics) are not on the Task Force's list.

General Education Courses

Table 27 summarized the responses to Questions 19 and 21 for the six general education courses.The most desired general education course was "Computers in Education," a course that some would contend is not a "true" education course, but an area that many mathematics teachers

Table 27

TOTAL NUMBER OF TEACHERS WANTING SPECIFIC GENERAL EDUCATION COURSES AND LOCATIONS TO WHICH THEY ARE WILLING TO TRAVEL

Name of General Education Course*	Number who want course	Augusta	Farmington	Ft. Kent	Machias	Oakland/ Waterville	Orono	Portland	Presque Isle
Advanced Ed Psych	62	17	8	3	1	13	17	31	3
Computers in Ed	169	41	25	9	6	20	46	77	9
Tests & Meas	80	20	12	4	3	14	29	31	6
Statistics In Ed	46	15	8	3	1	6	10	18	4
Intro to Ed Research	19	3	0	3	0	4	6	9	3
Cur & Org	43	12	11	2	1	7	14	17	3
Total number willing to travel to:		106	56	18	16	61	102	170	27

*Courses as listed on the survey were:
Advanced Educational Psychology
The Computer in Education
Tests and Measurements
Statistical Methods in Education
Introduction to Educational Research
Curriculum and Organization of Middle Schools and Junior High Schools

find they are requested to teach. Remember, in the last Section, that computers was the area in which the second largest number of teachers had taken further work. One person listed an additional course titled "The Teacher Made-Test/Grading/and Placement."

Only one course, "Tests and Measurements," was in the September 1987 Guidelines of the PBETM Task Force. It was the second most desired course of Maine's secondary school mathematics teachers. In the January 1988 PBETM draft report, the title was changed to "Evaluation of Student Learning."

Desire for Master's Degree

Table 28 shows the number of secondary school mathematics teachers who would like to pursue a master's degree in mathematics education at the University of Maine (Orono). This is a large number. When one considers that 195 respondents have a master's degree, this represents 66.4% of those mathematics teachers whose highest degree is a B.A.

Table 28

NUMBER OF MATHEMATICS TEACHERS
WHO WANT OR DO NOT WANT TO PURSUE A
MASTERS IN MATHEMATICS EDUCATION DEGREE
AT THE UNIVERSITY OF MAINE (ORONO)

Yes	No	Maybe
158	253	9

Opinions on Interactive Television

During the past year planning an interactive telecommunications system was the subject of considerable discussion at the University of Maine. Many of Maine's mathematics teachers find that they are in the same predicament as one teacher who was not willing to travel to any of the eight locations listed in Question 21. Underneath that question this teacher wrote "When you live

on an island, it's almost impossible to plan any night study except during the summer." Many of Maine's cites (and teachers) are in very remote and sparcely populated locations. To help alleviate the problems caused by this isolation, the University is hoping to have every high school is the state hooked up via interactive television by 1993. Table 29 shows the interest of Maine's secondary school mathematics teachers in taking a mathematics, mathematics education, or general education course via interactive television. As can be seen, there is considerable interest in either a mathematics or mathematics education course via this medium.

Table 29

NUMBER AND PERCENT OF MAINE'S MATHEMATICS TEACHERS INTERESTED IN TAKING A MATHEMATICS, MATHEMATICS EDUCATION OR GENERAL EDUCATION COURSE BY INTERACTIVE TELEVISION

Type of Course	Preference			
	Yes	No	Maybe	Percent "Yes"
Mathematics	303	58	8	82.1
Math education	296	52	7	83.4
General education	160	103	6	59.5

Improving Mathematics Education

Questions 23 and 24 asked Maine's secondary school mathematics teachers to provide specific comment on ways to improve mathematics education in Maine and in their schools. The last question, Question 25, was open-ended and allowed respondents to add any other comments. Complete responses for these three question are in Appendix C.

Responses to each of these last three questions have much in common. Rather than separately summarizing each question, it seems more pertinent to analyze them according to each comment's intended audience.

The first of these is a national audience. In most cases this national audience is the

mathematics education leadership—NCTM, curriculum developers and textbook authors. Next is a state audience, in most cases this applies to the Maine Commissioner of Education and the Department of Educational and Cultural Services.

There are two university audiences being addressed. One is the colleges of education and the other is departments of mathematics. In most cases, since this survey instrument was mailed from, and returned to, the University of Maine, these comments are directed to the University of Maine. Other universities in the state should also pay attention to these teachers' concerns. Another audience has been designated as elementary. Directed toward this audience are concerns of Maine's secondary school mathematics teachers toward elementary school mathematics. Both state and university personnel should be interested in this section. The last audience has been called local and has comments that can best be addressed by local school and community people.

National Audience. Most of the mathematics teacher's comments that relate to national issues are curricular in nature. Many dealt with the need for more, and better, applications of mathematics. For example, one teacher wanted "a book listing examples of higher math used in industry and business with examples using Algebra II and beyond in every occupation." Another teacher commented, "Students always want to know why they are learning what they are in math. I would find it helpful to be given information as to how a wide variety of other professions use math… " A third teacher said: "I think that use of computers can help in providing useful activities and applications in the classroom—some programs (like 'Green Globs' and 'Geometric Supposer') are useful learning tools, but more realistic applications need to be developed and disseminated among educators."

Somewhat related to the need for applications and career-oriented mathematics, was the need to improve the curriculum and the teachers of non-college preparatory mathematics courses. Frustration was evident in this teacher's comment:

> "General mathematics" courses are a joke. We try to teach arithmetic to 12th graders who have not learned this matter in the past 11 years. Why must we continue to attempt to do these tasks?

Another teacher said that there was a need to improve "math for lower level high school students. The materials available leave a lot to be desired, but our school is making a real effort." A third teacher wrote: "The general math area should be more vocational and business oriented instead of a hodge-podge of computation."

One teacher recognized the changes occurring because of technological improvements. The teacher may also have been responding to the draft Standards developed by NCTM (Commission on Standards for School Mathematics, 1987) and distributed widely throughout Maine by DECS. This teacher said that we need "more techniques and better materials for general math. Drill and Practice is being replaced by a calculator."

One teacher summed up the frustration that many teachers feel with the non-college preparatory mathematics curriculum. This teacher issued a challenge to everyone concerned with the teaching of mathematics:

> Math for the college-bound is relatively easy to provide, however, math for the low-achiever or for those who are failing elsewhere has taken a back seat and no comprehensive goals or program has been established. Many times these students are simply shuffled from one remedial course to another. A specific philosophy needs to be established and a program designated for these students or we are adhering to the belief that mathematics is for the upper 10% versus the common folk.

A few teachers commented on general curricular concerns. Three of them commented on classroom organization and stated, "Advanced math courses should include a lab once or twice a week similar to Physics and Chemistry to explore topics in greater detail," "Curriculum Design is of interest as is a remedial program for small numbers of students.... Are the present systems for teaching high school math becoming outdated?" and "There is too much fragmentation of math courses. Algebra and Geometry, etc. seem to be separate courses with little relation to each other. I think we should interrelate all math courses into Math I, II, etc. and correlate math, science courses more." This is a recommendation in the NCTM Standards.

State Audience. Most of the comments of the mathematics teachers that are directed

toward the state relate to certification requirements. As stated on page 13 the time this survey was conducted, the state was in the process of revising the certification requirements. Hearings had been held on a proposed list of requirements, but the final report had yet to be issued. These draft requirements had created much consternation among teachers that they were going to have to take additional courses within a short period of time or leave teaching.

With this background, it is easier to understand the teacher who said "If the state truly wishes to provide incentives for students to study to become math teachers they must provide the money. Simply raising the standards for certification will only increase the shortage of math teachers." Another teacher said, "I am teaching math because there is no one else to do it here in our system. This situation is going to be the case more and more unless something is done to attract good people into the fields of math and science. Maine is *hurting* for qualified math and science teachers."

Yet, as one teacher who was in favor of the proposed regulations remarked, "I agree with the new certification requirements for secondary/middle school math teachers. However, I do feel that experienced teachers lacking the requirements should be given an extended time to meet the new requirements with state money used as an incentive." [The proposed requirements contained standards for a separate certification for middle school mathematics teachers. These were deleted from the adopted regulations.]

Another teacher reflected on an all too common problem in the teaching of mathematics; and one that is not restricted to Maine. Compare this comment to the indented quote above.

> Without question the greatest need in our school is the need for qualified math teachers to teach our slower students in general math, bus. math, consumer math, etc. Our college math program is handled by qualified teachers. These other courses are thrown on teachers as extra fill-ins when their field may be English, science, home ec., etc. I think the teachers do their best, but do not have the background, and then it's the student who gets hurt. We need stronger courses to strengthen our weaker students' background!!

Along this same line, one teacher remarked that we should "allow only teachers with majors in math and a Master's degree to teach math at the secondary level." Another teacher

essentially said the same thing: "Any teacher teaching a math course in grades 7–12 should have been a math major in undergraduate school or have taken a comparable course load." As we saw in Table 21, 9.6% of the responding teachers stated that they were not certified. This percentage is too large. What effect can non-certified teachers have on their students and on the curriculum? Listen to what one of these teachers said:

> I am teaching a Pre-Algebra class because I have to. I have no choice. I have had all of 1 semester of Algebra in college and received a D because I had never had Algebra in high school and my college class was taught as a review. I am hoping to be teaching in my area (business) all of my 6 classes next year. I am doing my best however I still feel I am cheating my Pre-Algebra students. Even the Math Dept. does not like teaching these classes (because of discipline problems) which is why I am teaching such a class! I am teaching myself the best I can, but I am not comfortable.

The preparation of secondary school teachers was not the only concern. Several remarks were along this line: "Math education could be deeply improved in Maine if elementary teachers were specialized in various fields. Many of the teachers at the K-5 level were very poor math students and, thus, are very poor math educators."

University Audience. Most of the mathematics teachers comments were directed to the two university audiences. This part summarizes concerns that deal only with the university in general, rather than with individualized departments. Most of these comments referred to the inability to take courses because they were not offered or were not offered at times convenient to teachers. For example, one teacher said, "I have tried to take classes since I graduated but I cannot attend every day of the week during the summer. I prefer once or twice a week in the afternoon or evening.... We should be able to gradually take courses." Another teacher wrote, "I would like to see a more flexible schedule for courses at Orono. One night a week for 15 weeks is more than I want to take on at this point...." The difficulties that teachers face when going to school are reflected in this teacher's remark: "I teach school every day. Going to school after school is over is a burden to me."

One teacher commented on a personal philosophy toward what the University should

expect of students who want to become mathematics teachers: "I strongly believe that a math student who is preparing to become a teacher needs a strong math/liberal arts program. The student's fifth year should be a residency with an experienced math teacher. Practical versus theoretical application of knowledge."

Mathematics Audience. Perhaps most of the teachers' remarks directed at the mathematics department were due to teachers inability to obtain mathematics courses in the evening, during the summer or at off-campus locations. Many mathematics teachers feel that they are no longer competent in calculus—an area which they took as college freshmen and may not have had much use for since then. Many teachers would like to take a refresher course in calculus to make them more qualified to teach the course in preparation for graduate courses in mathematics. One teacher spoke for all of them with the statement:

> Courses should be available for teachers to review areas of math they may have studied years ago. In other words, teachers also need reinforcement of concepts. Courses where teachers share ideas about teaching and [about] methods of teaching mathematics.

Availability of graduate courses was also concern. Teachers want courses offered at times and locations that are more convenient. They do not all agree when those times or where those locations should be. Some suggestions were: "By offering more math courses during evening classes at the closest sister universities," "By providing mathematics or mathematics education courses at locations other than Orono or Portland [and] at hours convenient for working teachers," "Courses must be offered during late afternoon and evenings when teachers can attend—and offered in the more populated areas i.e. Portland" and "Courses should be in late afternoon or evening."

Elementary Audience. Several comments expressed concern about the mathematics preparation of the elementary school teachers. As one teacher remarked "Elementary teachers should also take more math courses—2 general math courses shouldn't be the only credits a teacher needs in order to teach." Another said that the mathematics preparation "... is the

Achilles heel of math (and science) education." One teacher felt that the University should "create more courses for the elementary and junior high teachers. The basics are learned at these levels. Without elementary and junior high teachers, high school teachers might not have anything to work with." Still another said, "Elementary classroom teachers should be required to gain proficiency in teaching skill areas of fractions, percents, prime numbers and problem solving."

One teacher was not as concerned about the preparation of the elementary school teachers as about the time they spent teaching mathematics. "Elementary schools should place as much emphasis on mathematics as they do on reading and writing." Another comment on the teaching of elementary school mathematics reflected concern for the teaching methods used by elementary teachers. "There is a need at the K-8 levels to employ more concrete learning experiences - use manipulatives and activities to reinforce rather than worksheets. Science is not the only area where laboratory experiences are essential to concept development or mastery."

Local Audience. There were few comments that could be considered to be of interest to local school districts. Most of these dealt with administrative aspects. For example, one teacher said "... We have one person teaching math who doesn't belong in the classroom - no discipline - doesn't care attitude, yet no administrator will move to change his ways."

Another expressed frustration with the way the school's mathematics department was being administered. "All teachers must be allowed to teach higher math courses. Presently, the dept. head teaches these and also controls which, if any, conferences we may attend. Meanwhile, we (the rest of the dept.) make do with Algebra I and Geometry and stagnate."

The final comments are on a more positive note. Yet they express a perennial concern among mathematics teachers—poor communications with the mathematics teachers in the other buildings. One commented that the school needed "better relations between high school and middle school teachers" and another felt the need for better "communication among teachers, intra-school workshops."

* * * * *

This concludes the look at the teachers survey. This portion of the two surveys has the greatest implications for developing a graduate program in mathematics education at the University of Maine. In this section, we focused on

- The mathematics courses that Maine's secondary school mathematics teachers are most interested in taking
- The mathematics education courses that are of most interest to Maine's secondary school mathematics teachers
- The general education courses preferred by Maine's mathematics teachers
- The locations where these teachers would prefer to take these courses
- Comparing the courses preferences of Maine's secondary school mathematics teachers to a June 1988 draft curricular Guidelines being prepared by a committee of the National Council of Teachers of Mathematics

We also looked at the teacher's recommendation for improving mathematics education in the state of Maine and for improving the mathematics program at their schools. In the next section, the results will be summarized and the next procedures in developing a graduate program at the University of Maine will be outlined.

VI. Summary and Next Steps

In January 1988, a survey instrument was mailed to Maine's secondary school principals. At the same time, a second related instrument was mailed to Maine's secondary school mathematics teachers. The purpose of these instruments was to obtain a "snapshot" of Maine's secondary schools and their mathematics teachers and to obtain an indication of the graduate courses these teachers are interested in taking. Useable responses were returned by 115 (60.5%) of the principals and 433 (45.1%) of the teachers. This report contains the analyses of the returned survey instruments.

Summary

The most significant findings were the mathematics, mathematics education and graduate education courses desired by Maine's secondary school mathematics teachers. These findings were listed in Tables 25, 26 and 27 in the same order in which the courses were listed on the Teacher's Survey. Table 30 summarizes these results in one table by listing the courses in the order in which Maine's secondary school mathematics teachers ranked each course and by indicating if the course was recommended by NCTM's Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM).

Table 30

COMPARATIVE LIST OF DESIRED MATHEMATICS, MATHEMATICS EDUCATION AND GENERAL EDUCATION COURSES AS RANKED BY MAINE'S SECONDARY SCHOOL MATHEMATICS TEACHERS AND WHETHER LISTED BY NCTM'S PBETM TASK FORCE

	Mathematics		Mathematics Education		General Education	
Rank by Teachers	Title	NCTM list?	Title	NCTM list?	Title	NCTM list?
1	History of Math	Y**	Problem Solving . . .	Y	Computers in Ed	
2	Probability	Y	Teaching Algebra		Tests & Meas‡‡	Y
3	Theory of Equations	Y*	Teaching Geometry		Adv. Ed Psych	
4	Discrete Math	Y	Teach Adv. Topics		Statistics In Ed	
5	Number Theory		Models of Teaching**	Y	Cur & Org	
6	Geometric Linear Alg.		Current Curriculum	Y	Intro to Ed Res.	
7	Algebra	Y	Technology in SSM	Y		
8	Statistics	Y	Diag. and Remed†	Y*		
			Psych. of Teaching‡†	Y		
9	Non-Euclidean Geom.	Y				
10	Adv. Euclidean Geom.	Y	Teaching Mid/Jr H.			
11	Approx. Methods					
12	Modern Analysis†	Y				
	Numerical Analysis†					
14	Advanced Calculus					

* Listed by NCTM in September 1987 draft, but not listed in January 1988 draft report of PBETM
** Not listed by NCTM in September 1987 draft, but listed in January 1988 and June 1988 drafts
*** January 1988 Task Froce report changed title from "Models of Teaching and Instructional Strategies for Secondary School Mathematics" to "Mathematics Instruction in Grades 7–12"
‡ January 1988 PBETM report listed title as "Psychology of Mathematics Learning"
‡‡ January Task Force report changed title from "Tests and Measurements" to "Evaluation of Student Learning"
† tie

The findings in Table 30 can be summarized as follows:

- The four mathematics courses that received the highest ranking from Maine's secondary school mathematics teachers were History of Mathematics, Probability, Theory of Equations and Discrete Mathematics. All except Theory of Equations are among the recommended courses of NCTM's PBETM Task Force.

- Problem Solving, Teaching of Algebra, Teaching of Geometry and Teaching of Advanced Topics were the four highest ranked mathematics education courses by Maine's secondary school mathematics teachers. Only the Problem Solving course is on the June 1988 draft list developed by NCTM's Task Force.
- Computers in Education and Tests and Measurements were the top two general education courses of Maine's mathematics teachers. The second of these is on NCTM's list. While Computers in Education is not, it does contain much of the content in one of NCTM's courses—Technology in Secondary School Mathematics.

Some other results of this survey that will have direct impact on the development of a graduate program in mathematics education and on how the courses in that program are offered, are the following:

- 158 teachers indicated an interest in pursuing a master's degree from the University of Maine. This represents 66.4% of those teachers who do not have such a degree.
- Over 82% of responding teachers are interested in taking a mathematics or mathematics education course via interactive television.

There were some other interesting results. While each of these results, listed below, will not impact on the development of a graduate program in mathematics education at the University of Maine, they may deserve to be studied further to see if the data are consistent and to determine some possible causes and/or solutions.

- 27.4% of Maine's secondary school mathematics teachers who are certified did not have either a mathematics major or minor when they received their bachelor's degree.
- 80.5% of Maine's secondary school mathematics teachers who are *not*

certified did not have a mathematics major or minor.

- There is a correlation of r = 0.902 between the percent of schools that subscribe to professional mathematics education journals and the journals that are read by secondary school mathematics teachers.
- 96.3% of principals reported that they encourage their teachers to pursue professional development activities. However, only 65.1% of the teachers reported that their administrators encourage them to pursue such activities.

Teachers and principal's commented on ways to improve mathematics education. Both groups had essentially the same concerns.

- They want better non-college preparatory mathematics courses. As one teacher said "'General mathematics' courses are a joke."
- They want more realistic and better applications of mathematics.
- They want more realistic and better career-oriented mathematics.
- They want better prepared teachers—not only at the high school, but at the middle and elementary levels. Almost 28% of the principals commented on the need for better qualified teachers
- In order to update, maintain and improve their teaching, teachers want graduate level mathematics and mathematics education courses and they wanted them offered at times and locations when they can attend, i.e. closer to their school sites. As two teachers said:

"I would like to see a more flexible schedule for courses at Orono. One night a week for 15 weeks is more than I want to take on at this point although I would enjoy some chances to talk and learn more about mathematics."

"I would love to have a Masters degree in mathematics, but the

remote area I live in makes it difficult to do so. Orono should offer extensive use of telecommunications system."

- Teachers expressed a need for some course designed to help them update skills, such as calculus, that have declined through disuse
- Principals and teachers believe there is a need for better communications among people teaching all levels of mathematics. This included intra- as well as inter-school communication.

Next Steps

This was the first step in looking at the *status quo* of secondary school mathematics in the state of Maine and in determining the needs of Maine's schools and their mathematics teachers. The results of this study will be used to help determine what should be included in a graduate program in mathematics education at the University of Maine. As stated in the Introduction, whenever a new program is initiated, the following must be taken into consideration:

- Standards of accrediting associations such as the National Council for the Accreditation of Teacher Education (NCATE)
- Recommendations of professional organizations such at the National Council of Teachers of Mathematics (NCTM) and the Mathematical Association of America (MAA)
- Concerns, interests and needs of the people the program will primarily serve, in this instance the mathematics students and teachers of Maine.

Preferences of Maine's secondary school mathematics teachers differ in several instances from the draft recommendations of NCTM's Task Force to Develop Guidelines for the Post-Baccalaureate Education of Teachers of Mathematics (PBETM). One of the next steps is to attempt to resolve these differences in order to design a model mathematics education curriculum for Maine. The latest version of NCTM's *Guidelines for the Preparation of Teachers of*

Mathematics (Commission on the Education of Teachers of Mathematics, 1981) is used by NCATE when its members examine an undergraduate teacher education program. Will the recommendations of the PBETM Task Force become the *de facto* standards for judging graduate programs in mathematics education?

Many teachers expressed concern and frustration in their difficulty in finding mathematics (and education) courses at times and locations that allow them to go to school in the evening or summer.

- It is imperative that the University do everything possible to provide mathematics (and education) courses at times and locations that allow Maine's mathematics teachers to go to school in the evening or summer.

Maine's mathematics teachers want to be better, and the children of Maine deserve better mathematics teachers.

Another step that needs to be undertaken is to conduct similar surveys of Maine's elementary school and middle level teachers. How well do they feel their undergraduate program prepared them for teaching mathematics? Where do they feel a need for a stronger mathematics background? How should the undergraduate mathematics program be changed? What types of graduates level mathematics and mathematics education courses are of interest?

* * * * *

This report constitutes the end of a one step toward improving mathematics education in Maine. There are many more steps that need to be taken so that Maine's teachers are providing the best mathematics education possible for Maine's school children.

References

Bangor *Daily News*. (1988). *Master's degree requirements for teachers gets cool reception.* July 13, p. 7.

Begle, E. G. (1979) *Critical variables in mathematics education: Findings from a survey of the empirical literature*. Washington, DC: Mathematical Association of America and the National Teachers of Mathematics.

Boyer, E. (1983). *High school: A report on secondary education in America*. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Commission on the Education of Teachers of Mathematics. (1981). *Guidelines for the preparation of teachers of mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Commission on Standards for School Mathematics. (1987). *Curriculum and evaluation standards for school mathematics* Working Draft. Reston, VA: National Council of Teachers of Mathematics.

Dessart, D. J. (1987) *Guidelines for the post-baccalaureate education of teachers of mathematics*. September 1987 draft. Reston, VA: National Council of Teachers of Mathematics.

Dessart, D. J. (1988a) *Guidelines for the post-baccalaureate education of teachers of mathematics*. January 1988 draft. Reston, VA: National Council of Teachers of

Mathematics.

Dessart, D. J. (1988b) *Guidelines for the post-baccalaureate education of teachers of mathematics*. June 1988 draft. Reston, VA: National Council of Teachers of Mathematics.

Haberman, M. (1986). Licensing teachers: Lessons from other professions. *Phi Delta Kappan*, 67, pp. 719-722.

Hawley, W. D. (1986). Toward a comprehensive strategy for assessing the teaching shortage. *Phi Delta Kappan*, 67, pp. 712-718.

Holmes Group, The. (1986). *Tomorrow's teachers: A report of the Holmes Group*. East Lansing, MI: The Holmes Group.

Holtan, B. (1986). *West Virginia secondary mathematics teachers: 1964, 1974, 1984*. Morgantown, WV: College of Human Resources and Education, West Virginia University. ERIC Document No. ED 275 491.

House, P. (1982). *Mathematics teachers: An endangered species*. Mathematics Education Information Report. Columbus, OH: ERIC Clearinghouse for Science, Mathematics and Environmental Education. ERIC Document No. ED 223 413.

Kouba, V. L. *et al.* (1988a). Results of the fourth NAEP assessment of mathematics: numbers, operations and word problems. *Arithmetic Teacher*, 35, pp. 14-19.

Kouba, V. L. *et al.* (1988b). Results of the fourth NAEP assessment of mathematics: measurement, geometry, data organization, attitudes, and other topics. *Arithmetic Teacher*, 35, pp. 10-16.

Magrath, C. P., Chair, National Commission for Excellence in Teacher Education. (1985). *A call for change in teacher education*. Washington, DC: American Association of Colleges for Teacher Education.

Mathematical Association of America. (1982). *Recommendations on the mathematical preparation of teachers*. MAA Noters Number 2. Washington, DC: Mathematical

Association of America.

Mathematical Association of America. (1988). *Guidelines for the continuing mathematical education of teachers*. Washington, DC: Mathematical Association of America.

McGeever, J. M. (1984). *State and local initiatives to alleviate teacher shortages in mathematics and science*. AEL Occasional Paper 014. Charleston, WV: Appalachia Educational Laboratory. ERIC Document No. ED 251 321.

McKnight, C. *et al.* (1987). *The underachieving curriculum: Assessing U. S. school mathematics from an international perspective.* A National Report on the Second International Mathematics Study, International Association for the Evaluation of Educational Achievement. Champaign, IL: Stipes Publishing Co.

National Commission on Excellence in Education. (1983) *A nation at risk: The imperative for educational reform.* Washington, DC: US Department of Education.

NCTM. (1980). *An agenda for action: Recommendations for school mathematics of the 1980s.* Reston, VA: The National Council of Teachers of Mathematics, Inc.

NCTM. (1988) NAEP: Results of the fourth mathematics assessment. *Education Week.* June 15, 1988, pp. 28-29.

National Science Board Commission on Precollege Education in Mathematics, Science and Technology. (1982). *Today's problems, tomorrow's crises*. Washington, DC: National Science Foundation. ERIC Document No. ED 223 423.

Roth, R. A. (1986). Emergency certificates, misassignments of teachers and other "dirty little secrets." *Phi Delta Kappan*, 67, pp. 725-727.

Schroeder, T. L. & Frame, M. L. (1986). The preparation and continuing education of mathematics teachers in Alberta: A status survey and needs assessment. Final Report. Prepared for the Mathematics Council of the Alberta Teachers' Association. ERIC Document No. ED 276 566

Snyder, T. D. (1987). *Digest of education statistics, 1987.* Washington, DC: Office of

Educational Research and Improvement, US Department of Education.

Sonnabend, Thomas. (1981). *A survey of doctoral programs in mathematics education.* College Park, MD. ERIC Document No. ED 201 518.

Task Force on Teaching as a Profession. (1986) *A nation prepared: Teachers for the 21st century*. Report of the Task Force on Teaching as a Profession. New York: Carnegie Forum on Education and the Economy.

Appendix A

Cover Letters and Survey Instruments

UNIVERSITY OF MAINE

College of Education
Office of the Dean

Shibles Hall
Orono, Maine 04469-0121
207/581-2441

January 4, 1988

Dear Maine Principal:

The College of Education at the University of Maine is conducting a survey of each middle level and high school mathematics teacher in the state. Information from this survey will be used to help us develop graduate level courses and programs in mathematics education designed to satisfy the needs of Maine's mathematics teachers. This information will also be used to develop some beginning data for longitudinal information about the state's teachers of mathematics.

The enclosed survey will provide supplemental information about the status of Maine's secondary school mathematics teaching and teachers and is being sent to each secondary school principal in the state. I am asking for your cooperation in collecting this information. Please complete the enclosed questionnaire and return it in the preaddressed postage-paid envelope. Of course, participation is voluntary and anonymous. You do not have to answer every question if you have concern about an item.

Thank you for your time and your help. With prompt returns, we should be able to inform you of some of the results in late Spring 1988. Please contact me if you have any questions.

Sincerely,

Robert A. Cobb

Robert A. Cobb
Dean

THE LAND GRANT UNIVERSITY and SEA GRANT COLLEGE OF MAINE

School Information from Principal

1. In what county is your school located?

O Androscoggin	O Aroostook	O Cumberland	O Franklin
O Hancock	O Kennebec	O Knox	O Lincoln
O Oxford	O Penobscot	O Piscataquis	O Sagadahoc
O Somerset	O Waldo	O Washington	O York

2. How many students are in your school?

O Under 100 O 100-299 O 300-499 O 500-1000 O over 1000

3. What grades are included in your school? O K O 1 O 2 O 3 O 4 O 5 O 6
O 7 O 8 O 9 O 10 O 11 O 12

4. Number of teachers in the school (including Principal, Assistant Principal, Vice Principal)

_____ Full-time teaching _____ Part-time teaching

_____ Full-time equivalent (include full- and part-time teachers)

5. Number of mathematics teachers in your school?

_____ Full-time _____ Part-time _____ Full-time equivalent

6. How many individuals are teaching mathematics in your school who are *not* certified mathematics teachers?

_____ Full-time _____ Part-time _____ Full-time equivalent

7. Is there a teacher on your staff who serves (formally or informally) as a math department head or math coordinator?

O Yes O No

8. Is there a specially equipped classroom in your school that is used as a "computer lab?"
O Yes O No
If yes, how many classrooms are being used as "computer labs?" _____

If yes, what grades have access to the lab(s)? _____

9. Is there a specially equipped classroom in your school that is used as a "math lab?" O Yes O No

If yes, how many classrooms are being used as "math labs?" _____

If yes, what grades have access to the lab(s)? _____

10. How many microcomputers do you have in your school?

_____ Total number in school _____ Number used primarily in school offices

_____ Number used in computer labs _____ Number rotating among classes

_____ Number assigned to one class (other than a computer lab)

11. What types of computer software are available in your school (check all that apply)

O Word processors for school staff O Word processors for students O Spread sheets
O Data base management systems O Drill and practice for students O Tutorials for students
O CAI authoring systems O Programming languages

12. Which of the following journals about mathematics teaching does your school receive? (Check all that apply.)

O Arithmetic Teacher O Journal for Research in Mathematics Education
O Mathematics Teacher O School Science and Mathematics
O Mathematics Monthly O College Mathematics Journal
O Mathematics Magazine O Assoc. of Teachers of Mathematics in New England Journal

13. How many teachers on your staff are members of mathematics education profession organizations such as the National Council of Teachers of Mathematics and the Association of Teachers of Mathematics in Maine? _____

In what ways, if any, do you encourage teachers on your staff to join mathematics education professional organizations?

14. Do you encourage teachers on your staff to participate in continuing professional development activities related to mathematics teaching? _____

In what ways, if any, do you encourage teachers on your staff to participate in continuing professional development activities related to mathematics teaching?

15. Would you encourage the mathematics teachers on your staff to pursue a graduate degree in mathematics education?

O Yes O No

If yes, how?

If yes, where?

16. In what areas do you think there is a need to improve the mathematics program in your school?

UNIVERSITY OF MAINE

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Office of the Dean

Shibles Hall
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January 4, 1988

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Sincerely,

Robert A. Cobb

Robert A. Cobb
Dean

Survey of Maine's Mathematics Teachers

1. In what county is your school located?

O Androscoggin	O Aroostook	O Cumberland	O Franklin
O Hancock	O Kennebec	O Knox	O Lincoln
O Oxford	O Penobscot	O Piscataquis	O Sagadahoc
O Somerset	O Waldo	O Washington	O York

2. How many students are in your school?

O Under 100 O 100-299 O 300-499 O 500-1000 O over 1000

3. What grades are included in your school? O K O 1 O 2 O 3 O 4 O 5 O 6
O 7 O 8 O 9 O 10 O 11 O 12

4. Please indicate your sex: O Female O Male

5. Please indicate the range which contains your age

O Under 25 O 25-34 O 35-44 O 45-54 O 55 and over

6. How many years have you worked in the field of education (count this year)?

O Under 2 O 2-5 O 6-10 O 11-20 O 21-30 O over 30

7. How many years have you taught in your present school (count this year)?

O Under 2 O 2-5 O 6-10 O 11-20 O 21-30 O over 30

8. How many years have you taught mathematics (count this year)?

O Under 2 O 2-5 O 6-10 O 11-20 O 21-30 O over 30

9. What are the grade levels of your *current* mathematics teaching assignment? (Check only one.)

O K-3 O 4-6 O 5-8 O 7-9 O 10-12 O 7-12

10. How many *classes* are you teaching this year at each of the following levels?

_____ Grade 7 math	_____ Grade 8 math	_____ Algebra I	_____ Algebra II
_____ Geometry	_____ Precalculus	_____ Analysis	_____ Advanced math
_____ Calculus	_____ Career math	_____ General math	_____ Shop math
_____ Other math (list)_____			_____ non math

11. Which degrees do you hold? When did you get them? What were your major(s) and minor(s)?

Degree	Year	Major	Minor
O Less than Bachelors degree	____	_____	_____
O Bachelors degree	____	_____	_____
O Masters degree	____	_____	_____
O Specialist degree	____	_____	_____
O Doctoral degree	____	_____	_____

12. Are you fully certified to teach mathematics at the grade level you teach ? O Yes O No

13. Have you taken any college courses since receiving the highest degree above? O Yes O No

If yes, please answer the following:

How many credit hours have you completed? _____

In what area has this work been done? _____

Does this work apply toward the requirements for another degree? O Yes O No

If yes, what degree is it? _____ What is your major area? _____

14. In your undergraduate preparation, which of the following university courses did you take?

___ Calculus	___ Advanced calculus	___ Real analysis
___ Differential equations	___ Linear algebra	___ Modern (abstract) algebra
___ Analytic/coordinate geom	___ Euclidean geometry	___ Other than Euclidean geom
___ Probability	___ Statistics	___ Prob. and stat (combined)
___ Combinatorics	___ Number theory	___ Discrete mathematics
___ Computer literacy	___ Computer programming	___ History of mathematics
___ Logic, sets and/or foundations of math		___ Mathematics teaching methods

How many weeks of practicum (student teaching) were included? _____

15. Please indicate the number of years since you completed a mathematics content course and/or a mathematics education course for credit. (Please check one in each column.)

Content Course	Education course
O 0-3 years	O 0-3 years
O 4-6 years	O 4-6 years
O 7-9 years	O 7-9 years
O 10 or more years	O 10 or more years

16. Please indicate the professional organizations to which you belong.

O National Education Association	O American Federation of Teachers
O Maine Education Association	O School Science and Mathematics Association
O Mathematics Assoc. of America	O National Council of Teachers of Mathematics

O Assoc. of Teachers of Mathematics in Maine
O Assoc. of Teachers of Mathematics in New England
O Other (specify) _____
O None

17. Which of the following journals about mathematics education do you regularly read? (Check all that apply.)

O Arithmetic Teacher
O Mathematics Teacher
O Mathematics Monthly
O Mathematics Magazine
O None
O Journal for Research in Mathematics Education
O School Science and Mathematics
O College Mathematics Journal
O Assoc. of Teachers of Mathematics in New England Journal

18. Does your administration encourage you to participate in continuing professional development activities related to mathematics teaching?

O Yes O No

If yes, how?

19. Which of the following graduate level courses would you be interested in taking for credit?

Mathematics Courses for Secondary School Teachers (mark 6 or less)

O Algebra
O Advanced Calculus
O Geometric Linear Algebra
O Modern Analysis
O Numerical Analysis
O Approximation Methods
O Probability
O Advanced Euclidean Geom
O Discrete Math
O History of Mathematics
O Number Theory
O Statistics
O Non-Euclidean Geom
O Theory of Equations
O Other (specify) _____

Mathematics Education Courses for Secondary School Teachers (mark 3 or less)

O Problem Solving in Secondary School Mathematics
O Technology in Secondary School Mathematics
O Current Curriculum, Teaching, and Research Issues in Secondary School Mathematics
O Models of Teaching and Instructional Strategies for Secondary School Mathematics
O Psychology of Teaching Secondary School Mathematics
O Methods of Teaching Algebra in Secondary School Mathematics
O Methods of Teaching Geometry in Secondary School Mathematics
O Methods of Teaching Advanced Topics in Secondary School Mathematics
O Methods of Teaching Mathematics in Middle Schools and Junior High Schools
O Diagnostic and Remediation in Secondary School Mathematics
O Other (specify) _____

General Education Courses (mark 2 or less)

O Advanced Educational Psychology
O Tests and Measurements
O Introduction to Educational Research
O Curriculum and Organization of Middle Schools and Junior High Schools
O The Computer in Education
O Statistical Methods in Education

20. The University of Maine (Orono) is planning to develop a Masters in Mathematics Education degree program. Would you be interested in pursuing such a degree?

O Yes O No

21. Which of the following locations would you be willing to travel to in order to take mathematics or mathematics education courses (even if you are not pursuing a degree)?

O Augusta	O Farmington	O Ft. Kent	O Machias
O Oakland/Waterville	O Orono	O Portland	O Presque Isle

22. The University of Maine is installing an interactive telecommunications system. When this is activated, you could take a course in your own school (say at 4:00). Would you be interested in taking such a course in mathematics, mathematics education or general education?

Mathematics	Mathematics education	General education
O Yes O No	O Yes O No	O Yes O No

23. In what ways do you think mathematics education can be improved in Maine?

24. In what areas do you think there is a need to improve the mathematics program in your school?

25. Other Comments:

Appendix B

Principal's Written Responses to Questions 13, 14, 15 and 16

Responses of 115 Maine secondary school principals to

Question 13: In what ways, if any, do you encourage teachers on your staff to join mathematics education professional organizations?

All teachers are encouraged to belong to at least one profession organization in their subject area.

All teachers are encouraged to join their respective organization.

Approve requests to attend meetings, workshops, visitations, etc.

Attend N. E. workshops, presenters at conferences.

Budget money for memberships if desired.

Budget monies for at least one math meeting of their choice each year.

Budget recommendations.

By granting released time for the above.

By helping to defray costs incurred by joining or attending functions.

By passing along info.

By paying dues and conference attendance costs.

By providing literature about organizations workshops, conventions, etc.

Circulate articles.

Department heads have national and state dues paid

Encourage attendance at conferences.

Encouragement through the department on periodic basis.

Financial incentives

For 1988-89, there is money in the proposed budget for an institutional membership in NCTE [sic].

Give them financial support to attend meetings.

Have school memberships in above [MT]

Individual choice

Individual choice

It is expected for a chosen career.

It is expected that they will be deeply involved in their chosen field and will grow and develop their skills to aid our students.

Meetings with individuals

None

None

One membership per department paid for by department.

Paid department membership. I recommend this for all departments.

Pass out info sheets to teachers.

Pay cost of professional room, board, and travel.

Pay dues

Pay dues, conference fees

Pay dues.

Pay for some.

Pay for their dues.

Personal contact.

Persuasion and providing release time

Professional Growth Leadership

Promote in handbook, personally, faculty meetings.

Promote professional growth.

Provide NCTM journal

Provide for attendance at state and regional conferences.

Provide information.

Recommend and suggest. Also, will pay institutional dues.

Staff development monies for conferences, organizations.

Subsidize attendance at meetings and conventions.

Suggest they join organizations.

Support attendance at conferences/workshops

Support dues and conferences.

Support time off.

Teachers/dept. can budget for one membership for department.

The are encouraged and time given to attend conferences/meeting, etc. if needed.

The district will pay 60% of their professional dues; also we support their requests for professional leave and encourage all staff to keep up with state of the art in all curriculum areas.

The school district pays the dues for each professional organization represent on the teaching staff.

The school or each department budgets money for all teachers to join professional organizations

The school pays dues

The school system pays for institutional membership to NCTM.

The school will NOT pay the dues.

They are given credit in their annual evaluations.

Through department head.

Through staff meetings, curriculum committees, and personal contact.

Time and money to attend conferences.

Verbal

We all go to professional meetings and all expenditures are reimburses. Dues and professional publications are a part of the mathematics department budget.

We encourage them to stay current in their area and to become members of their organization(s).

We pay 1/2 their individual dues.

We pay all expenses including travel for attendance at the meetings and workshops of these organizations.

We pay member ship.

We pay the fee.

We will provide dues and travel money if it has been budgeted by the teachers.

Workshops and conferences

52 blank responses

Responses of 115 Maine secondary school principals to

Question 14: In what ways, if any, do you encourage teachers on your staff to participate in continuing professional development activities related to mathematics teaching?

Area/regional meetings

Attendance at yearly PRISM workshop

Attend regional and/or national mathematics conferences

Attendance at math conferences

Attending different workshops

Attending local conventions

Attend conferences and workshops

Attend workshops periodically

BS/MS salary schedule

Budget money for teacher to go to different development conferences, etc.

Budget monies to be used at discretion of dept. head

By allowing teachers to attend local and regional mathematics conferences

By allowing the teachers to attend conferences on computers and curriculum study

By allowing them to attend seminars and conferences and by finding substitutes to cover their classes.

By attending professional development meetings offered throughout the state

By attending the summer session or math and science teachers offered at UMO

By course reimbursements

By encouraging conference attendance and school visitations and paying all associated costs

By granting (presently) recertification credits through a local staff development board

By having inservice workshops

By money and time support

By permitting professional leave

Circulate literature

Circulate literature

Conferences

Conferences

Conferences and workshops

Conferences, workshops, in–service

Conferences, courses (for certification, etc.)

Cost reimbursement

Course reimbursement

Courses/programs, etc. paid

Courses/workshops

Course work

Curriculum Development Committee

Distribute articles, books, and journals on math instruction

Distribute material I think will be of interest to them.

District pays for courses, workshops, seminars

Each year the whole department attends NCTM conference.

Encourage all staff to keep up with state of the art in all curriculum areas.

Encourage and pay for attendance at professional workshops

Encourage participation in professional organizations

Encourage to attend seminars and workshops and fund most of their expenses

Financial and moral support for participation in math meets

Financial incentives

Funding

Funding full week workshops/seminars

Give them info about conferences and workshops

I support them in their goals

I use strong verbal encouragement

In the summers we have held problem–solving discussions.

Inservice

Involvement in model for effective instruction

Involvement in professional associations.

Involvement in professional organizations

In–service

Make it an integral part of dept. meeting

Meetings with individuals

Notification thru D. H.

Offering them conferences to attend as they are brought to my attention

One day per year is required contractually for professional growth in their area. (Beyond regular workshop days.)

Paid conference expenses

Paid travel

Paid tuition

Participation in math meets

Participation in workshops

Pass on any information that I receive

Pass out info sheets to teachers

Pay all of their expenses to at least one conference per year in Maine or New England.

Pay costs of professional room, board, and travel.

Pay course work; 6 credits yearly

Pay expenses

Pay for conferences

Pay for courses

Pay for courses

pay for courses, conferences, visits

Personal contact

Persuasion and providing release time

Posting all staff development activities going on in the region

Professional days

Professional days are available

Professional days release from school

Professional development funds

Professional growth leadership

Professional leave

Professional leave

Professional leave with pay

Professional meeting

Professional time given

Provide financial support

Provide funding and released time

Provide funding for professional activities

Provide funds for all registration, meals, lodging, etc.

Provide in house development

Provide release time if necessary

Provide substitute

provide time, money

Provide with release time

Recommend conferences and other activities

Reimburse for course work

Reimbursement for travel/costs

Reimbursement for credits

Reimbursement or payment

Release time to attend in-service activities

Released time

Requiring recertification

School system may pay for a program and pay per diem pay to the teacher

Send them to workshops and fund them

Sharing relevant information

Staff development

Staff development–conference money

Stress to them the importance of professional growth.

Substitute teacher provided

Suggest they join organizations

Support workshop and conference participation

Support their requests for professional leave

Take them to the math meetings of Southern Maine Partnership

Taking courses at USM and other college and by attendance at NCTM related conferences

Taking courses for professional development

Taking graduate credits

Talk to staff

Teachers are given professional release time to participate in professional growth activities

Tell them to make their needs knows to the University

The mid-Maine symposium meets at Lincoln Academy

Through committee work and staff development

Through continuing education courses

Through staff development programs—time and money

Time and money to attend any mathematics related activity regardless of the location (within reason)

Time off and financial support are supplied

Time to explore other programs

To attend math related workshops and conferences

Tuition reimbursement

University courses

Urge attendance at conferences

We encourage participation of students under teacher supervision

We fund professional development activities and give time off

We pass on to math staff all information related to meetings, workshops, symposiums, etc. related to professional staff development

We pay 1/2 the tuition and 100% of the textbook costs for teachers taking advanced classes in their discipline.

We pay all expenses including travel for attendance

Workshops and conventions

Workshops, conferences, etc.

23 blank responses

Responses of 115 Maine secondary school principals to

Question 15: How do you encourage the mathematics teachers on your staff to pursue a graduate degree in mathematics education?

After seven years allow time off for advance study

Allotting extra time and money

Allow time from outside ?? [Could not read last word.]

Approve reasonable request for some release time to attend classes during the school day

Approve tuition reimbursement

As incentive to professional growth

Attempt to increase cost sharing

Budgetary support for tuition reimbursement

By course reimbursements

By having inservice workshops

By permitting professional leave

By reimbursing them for costs of courses

By tuition reimbursement

By words of encouragement and benefits to individual and department

Cost reimbursement

Course reimbursement

Course reimbursement, release time, salary scale

Courses have been offered locally

Course work at colleges and universities that meet their needs

Credit reimbursement

District participates in regional educational programs

District pays for courses

District provides time after teacher has been in district 7 years

District reimburses course work

Either through an academic year program or 3–year summer program

Encouraging teachers to teach higher level math classes

Evenings and summers, or sabbatical year school

Financial reimbursement

Financial support for classes

For gifted & talented education courses

Funding

Funding, encouragement

I encourage all teachers to continue their education in any manner that is effective.

I encourage it if it's something they want

If there was such a program

Incentives--negotiated salary

Increase in pay

Increase the salary for advanced degree

Indicate possible area that need improvement and recommend a course of study

Individual decision

Leave of absences if necessary

Making information available

Meetings with individuals

Much talking

Night classes

Night courses & summer school

One day per year is required contractually for professional growth in their area. (Beyond regular workshop days.)

Our school will pay the costs (in full) of participation in a masters program

Pay for cost courses

Pay for courses

Pay for courses

Pay tuition

Payment of tuitions and costs

Personal counselling

Personal encouragement

Persuasion and providing release time

Possibly by a leave of absence

Provide financial support

Provide financial support

Provide release time if necessary

provide support and increased pay

Providing tuition reimbursement and salary incentives

Provisions in the collective bargaining agreement for sabbatical leaves (full pay for half year or half pay for full year)

Recognition on salary scale

Reimburse for credits

Reimburse for credits

Reimbursement

Release time

Released time and payment of cost

Salary increases

Stress to them the importance of professional growth.

Summer school, salary paid by state

Support systems

Talk about it. Ask questions.

Teachers must see a direct benefit for them in the classroom. In short, how will pursuing a master's make them better high school math teachers

Tell them to make their needs knows to the University

The district pays for credit

Through continuing education

Through support system

Through the evaluation process

Through the evaluation process

Through the evaluation process

Tuition reimbursement

Tuition reimbursement

Two-thirds of the mathematics department have graduate degrees. The others are offered money and time to achieve degrees

Verbal encouragement

Verbal or written comments on evaluation

We can always improve

We do pay for higher degrees and recommend teachers go on for further education

We encourage all teachers to pursue graduate education

We pay 1/2 the tuition and 100% of the textbook costs for teachers taking advanced classes in their discipline.

We provide financial reimbursement and extra pay on the salary scale

We would pay tuition costs, assist with some release time, pay for sabbatical leave

Write references

35 blank responses

2 respondents indicated that all the math teachers in the school already have a master's degree

Responses of 115 Maine secondary school principals to

Question 16: In what area do you think there is a need to improve the mathematics program in your school?

8th grade algebra

A clearly defined curriculum or guide for grades 9–12

A real understanding of how kids learn and what they need. Help for teachers on how to deal with multi-levels in classroom

Add AP [advanced placement] class(es). Hopefully this will be realized within the next school year

Advanced placement courses

All areas

An improvement on basic skills and study attack skills–particularly from the grammar schools.

Applications of learned material/more interdisciplinary opportunities

Areas of low ability students

Basic arithmetic: fractions, decimals, percent

Basic understanding of math by vocational students

Better classroom material

Better curriculum for lower ability students

Better job of dealing with low ability students

Better qualified teachers

Better testing program to measure achievement, algebra readiness, etc.

Better transition from middle school

By doing more for the lower level student–what I don't know–I feel we are not reaching the very low student

Career education to show the need for advanced math.

Computer assisted instruction

Computers

Continue the involvement in Mathematics League

Continued math course work after students complete math graduation requirements

Coordination of goals and objectives through curriculum articulation
Coordination with other departments

Currently, we are undergoing staff development program in math

Curriculum development

Develop a mathematics lab/tutor system

Discrete math

Emphasis on attention to detail

Expanding elementary level and middle level grades problem solving units.

Figure out what to do to teach fractions

Find more time and quality time

Finding ways to allow students to work at their own pace

Focus. It is becoming ever less important to spend twelve years of a student's math education teaching him/her how to resolve equations & formulae. Learning how to develop algorithms to solve real problems is a much more meaningful focus.

Formal leadership

General area mathematics

General courses

Get all teachers to attend NCTM National and regional conferences

Give competency test and provide remedial help where needed

Greater range of electives for the advanced student

Higher expectations of students

Improve and increase communication with sending schools

Improve mathematics research center in the library

Improvement of teaching techniques

In the general level courses

In-service opportunities for the improvement of math instruction need to be expanded

Increase career awareness

Increase math requirement beyond 2 years

Increase use of computer (integrated into curriculum rather than contrived)

Integrate calculators and computers into the curriculum

Integrate use of computers

It is becoming increasingly more difficult to hire good mathematics teachers, without which our programs will definitely suffer.

K–12 coordination

K–12 coordination

K–12 program reassessment

Lack of K–12 coordination

Life skills use of mathematics

Lower ability students

Lower level preparation, vocational math

Make it more practical (show how/when it is used in the real world.)

Math league competition

Middle range students

More attention to general students and low achievers

More communication with middle school

More computer for individual drill and practice.

More drill in earlier grades

More hands-on approach needed

More lower to ?? ability classes

More practical approach for low groups

More problem solving

More relevant curriculum for non-college bound kids

More teachers and equipment

More thoughtful communication between teachers/students

Motivational techniques for teachers of middle and lower level math students

Need a 1-year high school algebra course in middle school

Need broader and stronger backgrounds for some teachers

Need for greater use of mastery learning techniques and to raise expectations

Need to address need of non–college bound

Need to integrate math topics and to move away from the compartmentalization of knowledge

None at the present time

Non–college track mathematics instruction

Opportunity for girls

Overall–increase student appreciation of math

Pedagogy and expectations.

Placing students at the correct math level at the start of the school year

Practical applications

Practical applications

Prealgebra 8th grade

Precalculus

Problem solving

Problem solving

Problem solving

Problem solving

Problem solving, logic, statistics

Problem solving/attitudes by students

Provide teacher time to assist students during their study halls

Raising student expectations

Senior math course

Sequencing of skills

Serious attention to doing homework by students in higher grades

Smaller classes

Some Algebra II students have complained that the class is too slow and basic, yet the teacher is reluctant to modify lessons to accommodate a few, accelerated students.

Staffing; facilities

Statistics

Statistics and discrete math specifically

Strengthening the algebra program. We are introducing a 2-year Algebra I course for our vocational students.

Stressing computation skills

Teachers need more training regarding methods, content, and motivation of students in low or low–middle levels of learning.

Teachers need to know more about their own learning and teaching styles.

Teachers of math need to know brain hemisphericity and its implications in student learning styles.

Teaching gifted and talented courses/seminars, etc.

Teaching low ability level students

Teaching math beyond Algebra II

Teaching methods

Teaching of calculus

Text books

The curriculum needs some changes and additions—especially in the geometry area

To be more efficient and effective

To cut down the teacher–pupil ratio

To increase teacher awareness and skills in teaching of unmotivated students and gifted underachievers.

To learn the principals of learning in teaching and be able to apply this to teaching math in the classroom

Too much emphasis in my schools put of gifted/talented program

Top level courses

Update texts

Upper level math

Use computers as a problem solving tool

Use of calculators and computers

Use of computers

We are satisfied with the present program

We need a better variety of courses for low ability students

We need more teachers able to teach higher–level math

We need to do more team traveling within the math dept.

We need to expand peer coaching experiences between math teachers

We need to provide more time for math teachers to meet or plan as a department

We need to provide greater opportunity for our high school math teachers to meet and dialogue with the math teachers at other grade levels and in other places

We need training in tracking that involves groups and team teaching

Working with lower level students, especially with computes to improve basic math skills

Younger teachers need more courses

24 blank responses

Appendix C

Teacher's Written Responses to Questions 23, 24 and 25

Responses of 433 Maine secondary school teachers to

Question 23: In what ways do you think mathematics education can be improved in Maine?

"?" do not know the problems in other schools

1/2-1 day workshops throughout the state (such as those done now with computers) to bring together math teachers and their ideas

A book listing examples of higher math use in industry and business with examples using Algebra II and beyond in every occupation

A good consumer math course should be offered (perhaps required) at every high school. "It's not what you make, it's how you spend it".

A lot more Practical/Applied Math given at all grade levels! - and a requirement to master same before being allowed to pass up to the next grade level!

A Master's Program taken to various regions is the first step. Workshops through CED that uses local people (part time) is another approach.

A Masters in Math Ed. degree is a start in the right direction. I think it should be set up like the NSF Math Institute that was offered back in the 70's in which I participated and received my Masters degree as a result. You have to offer stipends and waive tuition in order for most teachers to afford to further their education . They should not be allowed to enter this program until they have been in the field for a few years and experienced public education from the other side.

A Masters in Math Ed. with courses given in different locations would be a very good way.

A Masters in Math Ed. would be great! In my attempt to complete my Masters degree, I have had a great deal of difficulty getting the math courses because of the time they are offered (most during the day!).

A much better program, based on more student involvement, through relevance and applicability, with peer tutoring and "essential school" approach, needs institution at beginning grades, with expansion through the years to high school.

A uniform curriculum core should be established for three years and the fourth year course determined by the District.

All schools should require that any math teachers in junior high or high school be math majors.

All students should meet a minimum mathematics competency level prior to graduation.

Allow only teachers with majors in math and a Master's degree to teach math at the secondary level.

Allowing teachers to teach instead of being cafeteria, hall monitors!

Also how to make it interesting for the students

Annual independent consulting evaluative methods and summaries developed and carried out

Any teacher teaching a math course in grades 7-12 should have been a math major in undergraduate school or have taken a comparable course load.

Applications of mathematics courses (Algebra, Geometry, etc.)

Ask the legislature, they are experts in education.

At college, I had one 8 week methods course in math which wasn't enough. Longer and more diverse courses were needed. Elementary teachers should also take more math courses - 2 general math courses shouldn't be the only credits a teacher needs in order to teach.

Availability of courses relevant to teaching

Availability of Masters Programs to remote areas

Back to basics and stress comprehension and problem-solving

Because I was a biology major, I needed more credits in math and I found very little that would actually help me in teaching algebra and geometry in class. The choices in math courses at UMO at night were few.

Begin improving at elementary level-curriculum in lower grades should be improved-too many years wasted. Students could begin much earlier and so advance further in high school.

Better coordination between state, college and local school board on successful programs, new developments

Better information sharing

Better means of sharing ideas, programs, material, etc. between teachers via conferences. Exposing teachers to areas where math is used in communities in Maine and different fields.

Better pay scale for all teachers

Better pay to attract and hold qualified teachers, an apprentice program for replacement of experienced teachers facing retirement so new teachers don't have to re-invent the wheel.

Better preparation of teacher ed. programs

Better preparation of teachers - and sticking to standards once they are set for certification; i.e., no long-term waiving of requirements, just because of shortages.

Better prepared teachers in grades 5-8!

Better qualified teachers

Better selection of studies at undergraduate level

Better state funding

Breaking curriculum into smaller units so students could repeat units successfully before going on to new material. A year is too long to repeat at this level.

By doing everything implied in this questionnaire. Most math teachers would take advantage of courses if they were offered and the Masters in Education sounds great!

By doing research projects like this to find out what we think should be done.

By dropping educational requirements necessary for certification by making a degree in mathematics the requirement to teach - hire mathematicians to teach math

By following through on #21 and #22 as soon as possible!

By having great quality Mathematics Education courses such as the Teaching of Geom., Algebra, etc.

By implementing your program

By improving the quality of math instruction at the university level - they (many) are clearly out of touch.

By making math depts. teach the math classes instead of trying to come up with Business computer classes already offered - only because the Math Dept. does not like the caliber of students in lower classes!

By offering a masters program in mathematics

By offering more math courses during evening classes at the closest sister universities

By placing as much emphasis on math as in other areas (time and money) - other areas of interest have used our time and money to improve their programs i.e., Special Ed., Art, Sex Ed., Vocational areas, Driver Ed., Music, etc., all introduced at our expense.

By providing mathematics or mathematics education courses at locations other than Orono or Portland [and] at hours convenient for working teachers

By relying on the evaluations of the dept. head to judge coverage, delivery interaction, content, and method.

Certainly not by changing all the rules midstream and making them retroactive

College students need more practicums and student teaching experiences

Colleges should have higher math requirement standards (placement test)

Communication within district from grade to grade

Competency test before enter high school or graduate

Contract with competent teachers offering a salary commensurate with those offered in the private sector. Create a school atmosphere where scholastic activities are at least equal to extracurricular activities.

Coordinate many of the newer things going on; i.e., full time state math and computer consultants' work with College of Ed. and Math Depts. around the state at university level.

Course study in various areas

Courses for teaching non-college bound students mathematics. This is the BIG PROBLEM AREA! - General Math, Vocational Math, Basic Math

Courses must be offered during late afternoon and evenings when teachers can attend - and offered in the more populated areas i.e., Portland

Courses offered on the Telecommunications Systems

Courses should be in late afternoon or evening

Create more courses for the elementary and junior high teachers. The basics are learned at these levels. Without elementary and junior high teachers, high school teachers might not have anything to work with

Create more learning centers around the state so teachers don't have to travel. The telecommunication is excellent if students can respond to the teacher.

Creative Methods

Curriculum preparation needs to be addressed in undergraduate study in a realistic way.

Cut down on class interruptions.

Decimals and fractions in the grade school need more emphasis

Definitive answer by colleges of what is required to be taught in high school math. For example, are vectors, matrixes, determinants, probability required before college? (These are only examples). There seems to be no clear answer.

Delete the State Dept. of Ed.

Demand more from the students

Develop a good problem-solving curriculum

Develop a program to encourage good math students to enter the teaching profession.

Develop more teaching strategies and materials to give more hands-on activities and real applications for the math topics now being taught.

Diplomacy and home relations need addressing.

Disseminate the suggested math curriculum from NCTM

Don't know

Educating teachers much like a program like you are referring to here

Elementary classroom teachers should be required to gain proficiency in teaching skill areas of fractions, percents, prime numbers and problem solving.

Elementary schools should place as much emphasis on mathematics as they do on reading and writing. (National Statistics 3 hr./wk. vs. 11 hr/wk.)

Emphasis on problem-solving

Employing educators who like children and employing teachers who do not teach through fear and intimidation.

Encourage more good ideas to be passed around, through seminars and conferences.

Encourage school teams to visit other schools with working math departments, those proven to be successful.

Enrichment of teachers, observing others

Every five years he or she should take 6 hours in mathematics.

Every school should have a curriculum designed from grades K-12

Find a "magic pill" to enlighten students and parents regarding the need to develop a strong mathematics background to allow themselves broader choices in careers and better understanding a performance in whatever they do.

Follow up of the above

For future teachers emphasize techniques more than math content. I needed to learn about discipline, setting goals, motivating students, dealing with parents.

From your above mentioned Master's program in Math Ed.

Get and keep good teachers who challenge their students to progress as far as they can in the areas of total curriculum, current subject review of previous years, and problem-solving.

Get more qualified teachers.

Give teachers more time to develop curriculum - (period a day? summer employment).

Go after the teaching of Math in grades 3-6 In high school we get far too many students who cannot add, subtract, multiply, divide, work with fractions and decimals.

Greater coordination among the different grade levels K-12

Greater support by the universities in the 1st years of teaching - i.e., a required seminar to talk over problem issues

Have the math content apply to mathematics taught in the classroom.

Higher salaries for teachers

Hiring more teachers to lessen class size and separate preparations, then more time can be allotted to individual students and therefore aid their understanding

Howard Eves movie series available at MPBN

I agree with the new certification requirements for secondary/middle school math teachers. However, I do feel that experienced teachers lacking the requirements should be given an extended time to meet the new requirements with state money used as an incentive.

I am a great fan of competition between schools in math meets. We joined a math league four years ago and this has made a great increase both in the interest of math students, and also in their achievements both in class and in SAT scores, etc. If more schools became involved in the above it would improve math in Maine. As far as techniques etc. I'll leave that to you.

I believe math teachers need to have math teaching courses and content courses more available to us. We need to take these courses but because of teaching commitments are unable to travel long distances.

I believe that math teachers in the high school area should be better able to teach the upper level math; Calculus, Trig., Adv. Calculus.-and be encouraged to teach such courses. This would necessitate the bringing in of qualified teachers.-with degrees in Math, Computers or Engineering.

I completed no formal training before the computer was so important. I have taught myself a great deal, so it's hard to "fit in" in terms of finding an appropriate course to pursue. I suspect many are in this situation.

I don't believe there will be any significant improvement as long as we continue to give high school diplomas to anyone and everyone. We need to establish standards for graduation that students will have to meet. In this way, they would be motivated to work harder, and I believe, our best chances to improve our results lie in this direction.

I feel that I spent too many hours taking Calculus. I could have used more courses in problem-solving and computer in math classes.

I feel that teachers must be encouraged to continue their education and at the same time be provided with a financial incentive to justify their time. We must continue to educate ourselves to better educate our students.

I strongly feel that one should major in the field that she/he will be teaching in. For example, encourage the students to major in math if they are going to teach Math at the secondary level.

I think we have to show the students some examples of where we can use it, and show how important it is to have.

I would like to see more programs on math applications offered to teachers throughout the state.

I'd love to see summer seminars for math teachers. We at the middle school level could benefit from the opportunity to gather new ideas, find out about current research and trends and share ideas. If these exist, I'm not aware of them.

I'm in favor of pushing John Saxon's Math Books from grades 6 or 7 through grade 12. They make more sense and offer better practice for students than anything else available.

I, personally, would like to see more graduate level courses offered in local schools so teachers (who also happen to be mothers) are able to take them. The interactive telecommunications system sounds wonderful!

If more teachers were taking math courses (location of courses is important) a lot would improve.

If the courses are brought to locations that are easily available to teachers, especially Northern Maine.

Improve teacher training at college level

Improvement in elementary teachers' math preparation

Improving quality of teachers

In addition to the present requirements we need courses in how to present topics normally taught on the high school level.

Incorporate math and computers

Increase requirements for graduation

Increase the graduation requirements in math and science for K-8 education degree.

Increased expectations for instruction and pupils

Increasing teachers' pay so that teaching is attractive to math majors

Installing #20 would be a great boost.

Institute this Masters in Mathematics Ed. degree

Instruct teachers in problem-solving approaches

Instruction methods

Introduction to calculators at 9-12

It should be based on the math that is used in occupations. The entire educational system needs to be changed to be based on teaching Life Skills. Students need to see the connection between "Book Learning" and real life. They need to see how specific jobs use Math. Examples need to be shown and class work needs to reflect how math is going to be used after the students graduate.

Keep good Math Teachers

Less emphasis on content, more on student education

Less use of calculators in the math curriculum

Let's get the sources of employment of our students active in suggestion of the skills of mathematics they would like to see stressed.

Longer student teacher process

Maine needs more qualified math teachers in high schools. When vacancies open up (as it did here) there aren't any qualified people for the jobs so school administrators get bodies to fill the positions whether or not they have good qualifications.

Maintain state certification requirements

Make a wide variety of courses available throughout the university system.

Make courses more accessible to rural areas - particularly during the winter.

Make Math More Relevant to Jobs and Careers.

Make more literature accessible to people without writing to a million.

Making a bigger variety of graduate level courses available

Making courses more available to those of us who live long distances from the urban areas of the state

Masters and doctoral level math degree offerings for full-time working teachers

Match mathematics instruction with student developmental abilities in mind

Math courses for teachers should be taught by teachers with a demonstrated ability to teach on the secondary level. I have met few University professors who could function on the elementary or secondary level.

Math education could be deeply improved in Maine if elementary teachers were specialized in various fields. Many of the teachers at the K-5 level were very poor math students and, thus, are very poor math educators.

Math for the college-bound is relatively easy to provide, however, math for the low-achiever or for those who are failing elsewhere has taken a back seat and no comprehensive goals or program has been established. Many times these students are simply shuffled from one remedial course to another. A specific philosophy needs to be established and a program designated for these students or we are adhering to the belief that mathematics is for the upper 10% versus the common folk.

Math manipulatives must be used more in grades 6-12.

Math meets and competitions to stimulate learning

Mathematics education can be improved in Maine if the University would offer more advanced courses during their summer sessions when teachers are available to enroll in these courses.

Mathematics education courses for secondary school teachers and mathematics courses need to be offered for teachers like myself who haven't an undergraduate background in mathematics.

Mathematics teachers' conferences should be held in central locations such as Bangor.

ME-Link should be a toll-free number to allow more exchanges of ideas between the teachers in the Maine schools

Methods by which critical thinking may be reinforced in students

Methods course in geometry in Portland

Methods courses should truly teach ways of teaching concepts; no course that I took really prepared me to teach.

More "local" workshops, conferences and classes and other professional development activities

More advanced courses at night/summer

More concentration on developing an in-depth understanding of subject areas person is liable to teach.

More conferences of updated material with good, interesting speakers

More conferences re: math topics

More coordination of curriculum and consensus of what areas are important to teach in math today.

More course offerings/conferences/seminars

More courses could be offered in the evenings in Aroostook County.

More courses dealing with motivation of math courses

More courses in content available in more places and also in the summers

More courses in methods of teaching math

More courses need to be offered.

More courses offered near or in the schools

More courses offered on site

More diagnostic and remediation programs use reading labs and tutorial labs but no one with expertise in diagnosing and helping students who have difficulty with math.

More emphasis on "getting back to the basics" especially drills. I believe that schools should take a long and concerned look at what materials (topics) should be mastered and which should be "exposed to".

More emphasis on academics and less on social issues

More emphasis should be placed on the importance of mathematical problems and the various techniques for solving these problems.

More encouragement for females

More graduate courses in Augusta area

More hands-on experience and less methods classes

More incentive for good math students to enter teaching. Only allow "good" teachers into the profession.

More individual instruction & small classes make it easier for each student to progress from their own level and enable teachers to pick up problems or skills missed and reteach them. For the bright students it also lets them go ahead without having to wait for the "average" kid to learn a skill.

More input into Math Assessment Testing and correcting (by real Math Teachers)!

More interaction between college and high school instructors

More interaction with other math teachers

More involvement in math teams and national competitions

More math content, less education courses

More math courses available to teachers in the summer

More math required of students (3 or 4 years)

More math team (competition) within our own school

More math-education courses available to teachers in the summer

More money to retain math teachers - so easy for well qualified to find more money elsewhere

More pay for math teachers

More preparation time for faculty

More programs for gifted and talented

More programs so that mathematics teachers can meet and discuss problems or positive aspects of what is happening in schools or at least designated areas of the state.

More regional conferences for exchange of ideas

More school time allowed for staff to enroll in a graduate program etc.

More schools need K-12 coordinated curriculum in Math - ours being one.

More seminars and workshops

More stress on problem-solving techniques

More test and measurement courses would be of benefit for evaluating student performance

More time for sharing and coordination

More work on problem-solving techniques

Most math teachers need to learn more about the applications of the math that they are teaching.

Need a Masters program in the Portland area.

Network provided by state mathematics person covering a. Textbooks, b. Teaching materials, c. Exchange of ideas on teaching techniques

Not informed on subject

Not to allow someone to have a Masters Degree that cannot do simple math. Money must not be the only criteria for getting a degree.

Not to rely on bureaucrats who know not what it takes to be a good mathematics teacher

Obtain teachers who are interested in mathematics to teach mathematics - at all levels K-12 especially the lower levels.

Offer a more diverse curriculum at Maine University campuses. What is offered, for example at Portland, I have already taken or those that I would be interested in, are offered during working hours.

Offer courses in more locations around the state

Offer the Masters degree at Portland Campus

Offering courses that are relative to what is happening now in math and courses that are practical for recertification credits. Also refresher courses in calculus, etc. could be very helpful

Offering courses that help teachers become better math teachers

Offering higher degree programs at USM!

Offering more Math and Math Education courses around the area as you have indicated above

OK - none

One major concern is the area of math applicable to other content areas and applications of math in general. It's not that the students have not been exposed to the various concepts, they have. We've got to "put our heads together" to ease this concern.

One should approach the teaching of mathematics from a cooperative-learning, math-laboratory approach. Emphasis should be placed on inductive thinking, deductive reasoning, and problem-solving.

Participation of all math faculty in regional and New England conferences

Pay teachers a decent wage!

Perhaps a Woodrow Wilson type of summer program for Maine teachers

Possibly going to an integrated math program. I feel it is a waste of time to reteach Algebra I topics in Algebra II.

Prepare teachers to handle the non-college prep. classes. This is a specialty. These courses should not be assigned to the "newest" teachers.

Problem-solving

Problem-solving Skills

Produce a regent type exam for all state students

Provide calculators for use in schools

Provide more courses and/or workshops

Raise all teachers' salaries so they don't have to work second jobs, weekends and summers.

Raise salaries to attract talented high school students to teaching.

Raise salaries with bonuses if necessary which will attract better qualified personnel.

Raise standards for those entering teaching jobs.

Re-think what we are requiring and subject matter in light of current research.

Recruiting mathematics/science majors into teaching - this means to pay more.

Reduce # of preparations and classes taught - so out of class interaction with students is possible and think time available.

Regional course offerings during school year and summer to ease traveling

Regional math workshops

Relating math with English, Science, History, etc.

Require 3 years of mathematics at high school level

Require 4 years of math for high school graduation

Require a more vigorous curriculum for all students at all levels.

Require an exam

Require that all math teachers possess an undergraduate major in mathematics

Require that all teachers have a solid background in mathematics. Elementary school teachers need more (relevant) mathematics. Secondary school teachers need more techniques in motivation, etc.

Research to determine why so many students do not retain what they seem to learn. Example: division of fractions. So many forget year to year to year.

Self-paced materials for students to advance at own speed

Send professors and college administrators out to the field!

Should also have a minor in secondary education or its equivalent.

Starting teachers should be better trained in mathematics.

State requirement of 3 yrs. math in high school

State-Wide Workshop held at one location for Mathematics Teachers like Reading does

Stricter academic standards

Stronger approach to problem-solving

Students always want to know why they are learning what they are in math. I would find it helpful to be given info as to how a wide variety of other professions use math. I would like to do this on my own but there never seems to be enough time.

Students must learn to "think" and not just to "do".

Students should take more math classes.

Students' time is so diffused between myriad activities and athletics, that they really have very little time to spend on academics. The U. of M. is going down this same pathway so why should we expect High Schools to be any different.

Supervision of practicing teachers by a master teacher of math. I have a magnificent protocol if you're interested.

Support higher salaries for teachers so that we could spend more time improving our skills rather than working an extra job

Teach graduate level courses at night.

Teacher development, training

Teachers be certified in mathematics

Teachers need to be taught how to cope with test development grading models and ways to design questions for testing in all cognitive modes

Teachers should be encouraged to belong to professional associations, attend conferences and further their education with some financial assistance from their school.

Teachers should learn motivational techniques for the child who cares nothing about school.

Teachers should not teach more than 5 classes each day with 1 1/2 to 2 hrs. scheduled for lesson planning, etc. and extra help sessions for students.

Teaching educators different ways to approach topics - giving us different avenues to pursue

Textbook improvements

The program you mention in #22 sounds good for a state as large as ours.

The guidelines and requirements for a Math Ed. degree need to be stricter. More math courses should be required. These courses should be related to what is being taught in the schools (i.e., I'm teaching geometry and have only had one year from high school).

The state-wide math curriculum should be examined closely and changed according to changes in society.

The students need the basics drilled into them in the younger grades. We have so many students that reach high school and cannot multiply, divide, work with fractions and decimals, or begin to do problem-solving.

The use of the computer in the classroom, when used correctly could improve the quality of our math instruction.

There also should be separate methods courses for different levels of Math (i.e., Algebra I & II, geometry & Trig., etc.)

There are still many math teachers who are not aware of recommended curriculum changes, new methods or techniques because they do not attend conferences or talk to other teachers. If math education is to improve in Maine we must reach all math teachers K-12.

There is a need to improve the content competency of the classroom teacher - particularly K-9.

There should be better instructional material for teaching the lower level students. They seem to be pushed along and swept under the carpet instead of getting the solid fundamentals and more importantly the ability to apply the fundamentals.

There should be more coordination between the universities and high school regarding a pre-calculus course. There is one in operation now at U Mass. which might be an appropriate model for our state.

Those of us who live and teach in the Lewiston-Auburn area need more local opportunities for education. We live in a desert wasteland of opportunities, yet represent the 2nd largest

metro-area in the State of Maine. If I knew 25 years ago, what I see as reality today, I would never have moved here

Through open communications between mathematics teachers across the state

Through program offerings such as those implied by this questionnaire

To combine experiences outside the classroom with instruction in the classroom (i.e., field trips, guest speakers, etc.).

To get control of schools away from individual school boards so that curriculum can be more equal between small schools and larger (state controlled?).

To have more conferences involving high school mathematics teachers and college math professors to discuss expectations of both groups

Try to instill in students the desire to learn math.

Twice I started a Masters Program at UMF through USM and was told that I could get most of the courses locally. After 12 hours one time and 9 hours the other, the promises were not fulfilled. Credibility would be a big improvement.

Undergraduate students should take a course in diagnostic testing - how to administer, evaluate, develop!

University needs to have a higher standard for admission than it has had in the past. If your standards were higher, maybe we could impress on the students that they need to work harder in order to enter the University.

Updated texts/computer info

Use of highly trained personnel in the elementary classrooms - which means paying for professionals

Video on Math at Work in Maine

We are seeing high school students who start 9th grade poorly prepared in mathematics. They are weak in fractions, primarily. Perhaps our elementary teachers can be better prepared in mathematics education.

We need more detailed information on what things colleges feel should be stressed in Pre-Calculus and other advanced math classes

We need people competent in Mathematics in the elementary school so students are accustomed to higher expectations - teachers who are willing to deal with problems which expect students to think.

We need to increase the number of teachers who have a solid academic math background.

We need to promote students from one class to the next only when skills have been mastered. In our system we have entering high school. students who don't know multiplication facts,

who can't work with % and fractions. Having taught many years in another system I found this true also.

Work with elementary teachers on math topics such as problem-solving, pattern identification, set theory, and other non-basic topics.

Would like to see a 3 year minimum requirement for math courses for graduation from high school. The present requirement of 2 is not sufficient for such an important and practical subject area.

You must make more available at local areas - for example USM could run courses at your local H.S. More teachers would take courses without so much travel.

205 no responses

Responses of 433 Maine secondary school teachers to

Question 24: In what areas do you think there is a need to improve the math program in your school?

"General mathematics" courses are a joke. We try to teach arithmetic to 12th graders who have not learned this matter in the past 11 years. Why must we continue to attempt to do these tasks?

"Touch" math is being taught in the lower elementary grades and it makes it very difficult in upper elementary and junior high to show concepts of multiplication and division. This process must be either eliminated or re-worked to help in the concepts of math.

(Coordinate the curriculum K-12) - also stick to the basics and supplement from there as each teacher is capable.

3 yrs. of required math

4 Fundamentals of Arithmetic

A better diagnostic and placement procedure

A course for seniors who have taken Pre-Calculus, but are still not ready for (or do not need) Calculus

A curriculum for each course w/accountability!

A lot more Practical/Applied Math given at all grade levels! - and a requirement to master same before being allowed to pass up to the next grade level!

A more flexible mathematics program of studies

A program for remediation that has reasonable time/money/human resources

A semester consumer course should be offered to college-bound students.

Advanced placement offerings in Calculus or Pre-Calculus

Advanced math courses should include a lab once or twice a week similar to Physics and Chemistry to explore topics in greater detail.

Algebra I, Fundamentals

Algebra I should be taught at the 8th grade so that a rigorous course in Calculus could be offered the senior year of high school.

Algebra and Geometry courses at different levels

All areas

All students required to take math every year

All teachers must be allowed to teach higher math courses. Presently, the dept. head teaches these and also controls which, if any, conferences we may attend. Meanwhile, we (the rest of the dept.) make do with Algebra I and Geometry and stagnate.

Allow program to be evaluated from within instead of dictated from Asst. Superintendent (who's not a "Math" person).

Allowing teachers to teach instead of being cafeteria, hall monitors

Another math teacher

Another option for seniors who won't take Calculus but have had Analysis

AP courses such as Calculus and Pascal

Ask for copy of school improvement plan.

At least temporarily we need grouping of students to allow better students to deal with interesting and difficult material.

At present we have only 1 certified math teachers in grades 7-12. An additional math teacher would certainly improve our program.

Attempt to meet needs of all students

Advanced Math

Back to basics and stress comprehension and problem-solving

Basic "Arimethic" as my principal spells it K-8

BASICS in K-8!

Basics! Basics! Basics!

Better approach for low level students

Better coordination between Jr. High-High School Math classes

Better curriculum design

Better library facilities for mathematics

Better pay to attract and hold qualified teachers, an apprentice program for replacement of experienced teachers facing retirement so new teachers don't have to re-invent the wheel.

Better placement of students

Better placement of students

Better placement of students (tracking)

Better placement of students and/or math counseling

Better prepared teachers in grades 5-8!

Better relations between high school and middle school teachers

Better training of teachers

Better use of calculators and computers

By adding a pre-algebra course

By making math depts. teach the math classes instead of trying to come up with Business computer classes already offered - only because the Math Dept. does not like the caliber of students in lower classes!

By taking a closer look at student choices after graduation, we might see a definite need for the focus of more attention on a group whose needs may not be being met

Certain classes should be smaller in size

Close the gender gap in SAT and MEA tests.

Combine geometry with algebra.

Come colleges have indicated more need for calculus. (I think we are pretty solid.)

Communication among teachers, intra-school workshops

Computer Applications

Computer literacy (student and teachers)

Computer work needs to be integrated into math classes.

Computers

Computers

Computers in greater quantities must be made available for math student use.

Connection with other subjects/depts

Continued coordination with elementary schools

Coordination 6-12

Coordination of curriculum

Courses offered here at the school for the faculty

Creation of more useful and interesting problems for student solution

Critical thinking

Current applications in business and industry

Curriculum Design is of interest as is a remedial program for small numbers of students. Preparing a student for college math and for the real world. Are the present systems for teaching high school math becoming outdated?

Curriculum development

Curriculum development using integrated approaches

Curriculum is poorly, if at all, defined. Teachers basically are on our own to decide what to teach and when, limited only by our textbook.

Curriculum w/in district

Decreasing class size so that students receive more individual attention

Demand for students to take more math

Develop more teaching strategies and materials to give more hands-on activities and real applications for the math topics now being taught.

Discrete Math

Do away with early release of students so they will take elective math courses.

Don't teach geometry until sophomore year.

Elementary—Middle

Eliminate repetition of courses.

Equipment: Computers in the Classroom

Establishment of a District Math Department

Excellent program

Expand staffing to have more sections for homogeneous grouping.

Expansion of curriculum and offerings

Expectations!

Find a "magic pill" to enlighten students and parents regarding the need to develop a strong mathematics background to allow themselves broader choices in careers and better understanding a performance in whatever they do.

Flexibility of course offerings

Follow up of the above

General and remedial mathematics

General math-consumer math should prepare students for everyday usage of math

Geometry (concepts and applications)

Get students placed in appropriate courses so they don't slow down those who are appropriately placed. Get rid of the students who create so many problems for the school system. Students are given too many chances to interfere with education of others.

Gifted program for math students

Grade 11 - Non-Algebra courses

Grade-to-grade coordination

Have slower courses in Algebra and Geometry for some students.

Having a double period of math for Algebra I students a couple times a week

Having better qualified instructors for math classes

Hire staff members who are math teachers first, and other things (coaches, teachers of science and other subjects) second or not at all.

Honors classes

I am satisfied with the program I am presently teaching in. The school system has a strong Curriculum Review Team that just developed a Consumer Test that all Sophomores must pass or pass a semester long Consumer Math course for graduation.

I believe our program is fine as it is.

I believe that math teachers in the high school area should be better able to teach the upper level math; Calculus., Trig., Advanced Calculus.-and be encouraged to teach such courses. This would necessitate the bringing in of qualified teachers-with degrees in Math, Computers or Engineer.

I cannot think of any.

I feel our school has a good program. We do have one teacher who is not certified in mathematics. This is not the best situation.

I have students who don't work hard enough to stay in a regular class and become discipline problems in a lower level class. I feel if they test high enough and just don't do the work, they should not be moved to the slower class.

I think that the curriculum needs to be revised so that the students receive the continuity they deserve.

I think we already do as much as is possible but the acquisition of more computers might be of some benefit.

I would like to see two levels of Algebra I, Geometry, and Algebra II - the lower level geared towards the vocational or business student with less emphasis on proofs.

If more teachers were taking math courses (location of courses is important) a lot would improve

Improve attitudes

Improve teacher training at the college level

Improve the attitudes of the students. They must realize that effort must be given to gain success in their education.

Improved course work for the general math student

In light of new research, there is a need to examine the curriculum and weed out topics that are taught and retaught. We are slaves to the text-we need to enlarge childrens' math background., not rehash over and over.

In our system, we don't know what the other schools are doing, and they don't know what we expect.

In the area of discrete mathematics!

Include more hands-on, models of math concepts

Incorporation of manipulations and technology for average students

Increase in required # of years students should take math

Increase time allowed for mathematics classes.

Increased expectations for instruction and pupils

Individualized

Institution of an Honors track

Instructional approach/models of teaching

Integrate computer software which aides in demonstration of mathematics concepts

Integrate computers and calculators into the classroom more.

Integrate more problem-solving in the curriculum.

Integrated computer use

Integration of computers into the curriculum as a learning approach

Integration of technology

Introduce Calculus to advanced seniors

Involvement

Keeping better up to date with modern trends

Keeping the college bound student in a 4 year college math program

Knowledge of the teachers

Lack of courses for college bound student who is not in top "grouping"

Less emphasis on arithmetic as a prerequisite

Less students

Longer school day

Look at alternative texts

Low level math courses for non-college students

Lowering student/teacher number ratio

Make Math More Relevant to Jobs and Careers.

Math courses should be taught by math teachers.

Math For Low Ability Students

Math for lower level high school students. The materials available leave a lot to be desired, but our school is making a real effort.

Math for the general student. But I don't know if this is a mathematical related problem or a psychological problem.

Math teachers should be encouraged to take re-certification credits in math and allowed to attend professional conferences.

Math teachers should be math majors!

Mathematics is split between 5 or 6 teachers. Only 2 are full-time mathematics teachers.

Mathematics lab with instructor full time

Maybe a couple new electives - like number theory - or a more serious approach to Probability and Statistics

Methodology (techniques)

Methods of teaching problem-solving and an improved General Math curriculum

Middle school math teachers should be better prepared in mathematics

Minimum competency tests that must be passed (like they must pass English) to graduate

More application of mathematics to everyday life

More courses at the Junior and Senior years

More diagnostic and remediation programs use reading labs and tutorial labs but no one with expertise in diagnosing and helping students who have difficulty with math.

More elective courses

More emphasis on problem-solving and basic skills in all areas but especially 7th and 8th grades

More emphasis put on mathematics (require 3 yrs. for graduation)

More emphasis should be placed on students working together in small groups to solve problems.

More in-service math programs should be provided to keep teachers current and excited.

More in-service meetings

More integration of computers into the math curriculum

More involvement with all teachers in math

More math educated and "math minded" math teachers

More money should be provided at the top of our pay scales to attract the better candidates when hiring.

More money to attract quality

More needs to be done to promote problem-solving!

More offerings at high school level

More offerings in practical and consumer mathematics

More problem-solving

More problem-solving in curriculum

More professional time

More programs for gifted and talented

More programs for students not taking Algebra, at freshman level and at senior level

More relevant courses for the non-college bound

More space for a math lab

More stable curriculum

More structured General Math curriculum

More students should be better prepared for Algebra in the 9th grade.

More teachers

More teaching time per course

More techniques and better materials for general math. Drill and Practice is being replaced by a calculator.

More time for preparation

More time for sharing and coordination

More time to develop curriculum

More use of computers

More valuable courses for students who are not going to college

Motivate students, especially in non-college courses

Mt. Ararat has a very strong math program. We continue to revise it and upgrade it. I honestly feel the improvements needed are being made.

My school needs to encourage its math teachers to take college math and math education courses.

Need better communications between high schools and colleges

Need Coordination (1 person - we lack a Dept. Head)

Need evaluative techniques and summaries compared to gathered data on surrounding math curriculums

Need for a Math Coordinator or department head

Need more math courses aimed at different abilities - ex. those students pressured to go on to college (by parents, etc.) who do not have the ability to keep pace with the better, more motivated student. More course, mean more teachers, mean more room.

Need most improvement in offerings for academically weak students.

Need overall curriculum guidelines for K-12

Need qualified teachers which requires an increase in instructional budget

Need to develop concrete applications for Algebra I and Algebra II to show students in the classroom

Need to develop courses appropriate to the trade school bound student

Need to develop honors courses

Need to push for mastery

No

Non-college bound students still need exposure to a variety of topics that are presented to college-bound students only at a less in-depth scale.

Non-college student courses

None

None

None

None

None. Academic student has no math the last 2 years

Offer courses for talented and gifted

Offer courses in general problem-solving

Offer more courses for the "non-college" student - we have too many top level courses with too many students in them.

Offer more courses on the non-college preparatory level.

Open discussions between Elementary/Junior High/High School/College Teachers.

Our program is pretty good. We require 4 years of math - all college prep. Most students complete at least Algebra I, Algebra II, Geometry and some Trig.

Our scheduling needs to be improved and our courses updated.

Phase Algebra I & II was diversely more theory in course content.

Pre-Algebra in the 7th grade should only be for a select few advanced students.

Pre-testing students before placement in courses.

Problem Solving

Problem-solving

Problem-solving

Problem-solving

Problem-solving

Problem-solving made realistic, relative

Problem-solving skills

Problem-solving techniques/applications

Problem solving/estimation/high school advanced arithmetic

Problems with English measures as well as metric measures

Provide more money for conferences - (attending conferences at the National Level)

Raise graduation requirements to 3 or 4 years.

Recycle Algebra I students at the end of semester #1 if they cannot keep up.

Reduce apathy of vocational students towards math.

Reduce teaching load so the teachers get time for interaction with students and meet individual needs instead of trying to "cover" the curriculum.

Reduce the size of general math classes, and up-grade the material being used to teach the lower level math classes (Developmental and General (Consumer) Math).

Regular review of K-12 curriculum

Relevance to student's life

Remove some of the administrative roadblocks.

Repetition in elementary and junior high should be decreased. More concentration should be placed on applying the skills.

Repetitive curriculum K-12

Require that all teachers have a solid background in mathematics. Elementary school teachers need more (relevant) mathematics. Secondary school teachers need more technique in motivation, etc.

Restrict class size to under 25 students (some of our classes have well over 30 - some in rooms that are badly crowded with 25 in them.

Review our math curriculum

Sequential curriculum

Should have more consumer related classes for lowest tracks.

Small classes

Smaller classes

Smaller size classes - so teachers can individualize more

Space available for the department to work ; a. Together, b. With science

Stop changing programs just for the sake of change and improve what exists.

Strengthening our algebra program!

Stricter standards

Stronger backgrounds of teachers

Students need more help with solving word problems.

Students need to have a better outlook on school in general.

Students only need 2 math credits to graduate and I feel that they should have to take at least 3. We need to upgrade and improve our computer use.

Teach more problem-solving.

Teacher interest needs to be improved. Some teachers are bored, which makes them boring.

Teachers should be encouraged to take professional days to visit successful programs or meet with college officials more regularly.

Teachers should learn motivational techniques for the child who cares nothing about school.

Teaching lower level (division) students

Teaching problem-solving

Teaching those with low aptitudes

Techniques for motivating students

Testing of students to determine what courses they should take or be placed into

Textbooks

The addition of another math teacher with a strong background in math

The general math areas should be more vocational and business oriented instead of a hodge-podge of computation.

The local administration should encourage release time, monetary support, professional development

The math dept. at this school is most likely the best rounded department in the school. It's the educational setting set by the administrators that needs work.

The Middle School (6-8), especially for the remedial students

The school system needs another math teacher. That is happening.

There is a need at the K-8 levels to employ more concrete learning experiences - use manipulatives and activities to reinforce rather than worksheets. Science is not the only area where laboratory experiences are essential to concept development or mastery.

There needs to be more interaction of math-science-industrial arts programs for students to be more aware of how each is inter-related (the learning in one content area does not end as you walk out the door).

They are very balanced and quite adequately be reviewed and revised.

To combine experiences outside the classroom with instruction in the classroom (i.e., field trips, guest speakers, etc.).

Too many math classes are taught by unqualified, disinterested teachers. Therefore, there is no quality control nor curriculum control over what the students are taught. For these students a team approach needs to be developed to find points of interest, a tie between other classes the students are taking and a concrete exploration of math topics versus the purely abstract methodology.

Try to instill in students the desire to learn math.

Use of computer approaches to problem-solving in math

Use of computer in solving problems well-suited to that instrument

Use of computers in teaching math

Use of personnel who are mathematics-oriented

Use of updated series

Use of technology as a teaching tool and as a motivation/instructional device for the general student

We always need improvement in all aspects of our curriculum, but integrating non-routine problem-solving into our courses and greater coordination with the mathematical sciences are particular concerns.

We are currently working on developing problem-solving capabilities in our students, and are also exploring cooperative education.

We are currently writing a K–12 curriculum. Our school needs to look at addressing placement programs for advancement.

We are on top of all current and new ideas - usually setting the trend.

We can always improve, however, I think in the area of General Math we are the weakest.

We could continue to motivate our lower level students.

We could improve coordination of multiple college level courses.

We could study problem-solving at all levels

We feel we are improving our program now by better coordination between grade levels, testing to show areas of weakness and growth and frequently updating our texts.

We have a fine math curriculum in Auburn. However, there exists a need to shift toward individualization in order to meet students' needs & community expectations.

We have a very good Math Program. Efforts to keep current and maintain present gains.

We have recently made several changes to improve the mathematics program at our school.

We have to be much more realistic about the students' achievements. Students do not know the basics but we are being pushed into lowering standards so these students pass college courses.

We need a Math Coordinator or Dept. Chair.

We need a remedial math program and computer assisted learning.

We need an interesting, relevant math program for our average - low average students. We have one person teaching math who doesn't belong in the classroom - no discipline - doesn't care attitude, yet no administrator will move to change his ways.

We need decisions on appropriate curriculum for which the state is giving ambiguous information.

We need help with the addition of calculators, computers, and problem-solving to the curriculum.

We need more teachers so that we can offer the student a course at his/her level - I now have kids in Algebra because they happen to be in band!

We need strengthening of the elementary program - levels of competency which must be passed before students move on.

We need time to talk about and share our methods of teaching.

We need to have better placement strategies between college prep. and honors levels.

We need to increase the aspirations of students.

We need to know workable, success-oriented methods of teaching students with low ability.

We need to offer courses that satisfy the varied levels of academic abilities that our student body exhibits. This is necessary to keep more students involved in Mathematics for more than two years.

We need well qualified people for the higher level math courses that can teach.

We still need to work with the students on problem-solving. We need to take away the fear that is evident. Also, we must continue to strengthen their ability to work with fractions and decimals.

Wider offering of math course, and offer more of what we have to different levels

Wider variety of offerings

Without question the greatest need in our school is the need for qualified math teachers to teach our slower students in general math, bus. math, consumer math, etc. Our college math program is handled by qualified teachers. These other courses are thrown on teachers as extra fill-ins when their field may be English, science, home ec., etc. I think the teachers do their best, but do not have the background, and then it's the student who gets hurt. We need stronger courses to strengthen our weaker students' background!!

Work needs to be done on curriculum development

208 no responses

Responses of 433 Maine secondary school teachers to

Question 25: Other comments

A "grandfather" clause should be available for certification for people who have taught a particular subject for a number of years but who did not originally receive their degree in that field.

A few years ago I gave thought to a Sabbatical Leave - checked Math Dept. at USM. They could not assure me in the spring that I could take courses in the fall.

A Master's Degree is fine, but it must be $^2/_3$ content courses.

About time this type of program is offered to secondary math teachers

All of the mathematics teachers at our school have their Masters degree. We would like to pursue a CAS., if courses were available.

An advanced degree program in mathematics education is exactly what I've been looking for.

Auburn should be another area that you consider locating these courses.

Be aware that I do not teach Math every year.

Courses should be available for teachers to review areas of math they may have studied years ago. In other words, teachers also need reinforcement of concepts. Courses where teachers share ideas about teaching - and methods of teaching mathematics.

Develop a math program that automatically leads to a renewal of the State Teaching Certification as it is proposed to be. The State is going to lose a number of qualified teachers because of the confusion of the renewal system.

Develop a model program of in-service education for K-6 teachers in the instruction of math and science.

Education has taken a drastic turn-about in the past 10 to 15 years. Education in academics has taken a back seat to "worldly exposure". I think some of this may be important, but we seemed to have overdone it.

For the sake of others, it is too late for me, I hope the whole system can work together. As things are now, every campus has their favorite courses and they gain the $ and everyone else loses, including the students.

Glad to see this!!!

Good luck in your studies. Don't forget the individual student in all your work-nor the society he must live in. Keep in mind the restraining forces that so often discourage many teachers from thinking that improvement is attainable - time, $, leadership, geography, local cultural perspectives, student/parent/teacher attitudes, etc.

Hope you are really serious about addressing our needs.

Hopeful that a wide selection of mathematics courses for teachers will be available this summer

How will the information be publicized?

I am a science teacher. I do not enjoy teaching math for math's sake. Applied Math is what I am interested in. I am teaching math because there is no one else to do it here in our system.

This situation is going to be the case more and more unless something is done to attract good people into the fields of math and science. Maine is hurting for qualified math and science teachers.

I am about to leave teaching. I strongly believe that public education is a failure for 40-50% of all students and a disappointment to the rest. Public Education was developed for training prior to industrial work, and we are well beyond the industrial age.

I am currently enrolled in a Graduate Program at USM - Educational Administration.

I am interested in taking Math Ed. courses. As I learn math, I want to see how to bring what I'm learning into the class. Much more of teachers' education needs to be based on teaching practice. Math teachers do not need nearly as many advanced math courses as education courses.

I am moving away from teaching math to teaching and administrating computers. All my recent study has been in that area.

I am not interested in taking courses at this time. I think I can better use my time in attending conferences and developing my own ideas.

I am presently trying to find a way to work towards my M.Ed. in ME. However, it is not offered in the State of ME. I live very close to NH but UNH will be expensive. It is very frustrating and disappointing that ME won't help me to meet my goals.

I am primarily a science teacher.

I am teaching a Pre-Algebra class because I have to. I have no choice. I have had all of 1 semester of Algebra in college and received a D because I had never had Algebra in high school and my college class was taught as a review. I am hoping to be teaching in my area (business) all of my 6 classes next year. I am doing my best however I still feel I am cheating my Pre-Algebra students. Even the Math Dept. does not like teaching these classes (because of discipline problems) which is why I am teaching such a class! I am teaching myself the best I can, but I am not comfortable.

I can remember when a student was supposed to get 200 minutes per week in each subject (at high school level). In one of my classes this year, the students got 150 minutes of instruction total in 2 wks. time.

I cannot commute to Orono - please run a Masters Program in Math at Portland/Gorham.

I do not think the way to better education is through more content or methods courses. I have taken courses one night a week for two years. It takes time away from school preparation time as well as adding to the fatigue level.

I don't believe that the pay scale would encourage advanced Math teachers/Computer teachers-in that industry is better able to remunerate such degrees-thus the lack of those able to teach advanced math.

I don't need more advanced training. I can only use a small part of my training now. I have a tough time keeping up with teaching 5 preps, coaching 3 teams, running a dept., and all the committees and paperwork that comes my way.

I feel that in the "Average" math class too much of the Thinking is done by the Teacher, me included, and the student thinks that Math is a system of operations.

I feel that my own performance would be improved by taking methods courses aimed at teachers in the classroom.

I have an Engineering Minor, etc. and will be leaving the teaching profession as I have found that even though I enjoy teaching in the high school, I can't "afford" to stay in the profession.

I have tried to take classes since I graduated but I cannot attend every day of the week during the summer. I prefer once or twice a week in the afternoon or evening. Only if I were strongly in a program could I set the time to spend an entire summer. We should be able to gradually take courses.

I hope that things get put together in time for me to take advantage of the Masters Ed. Math Program.

I need more people in my dept. who can see beyond the daily regimen of teaching from a text. My staff is not completely disinterested in improving; but I need at least one other who will share ideas on a much higher level of mathematical thinking and thoughts on improvement of curriculum based on current research results.

I need two 3 hr. courses in the next 5 years.

I personally do not have the time to travel long distances to take math courses. It would be a plus in my favor to have more math courses offered closer to home.

I plan to retire in 3 yrs. after 27 yrs. of teaching (my certificate expires then). I enjoy teaching and have enjoyed it, but I would not enter the field today.

I sincerely hope that you will follow through and offer courses in the Waterville (Central) Maine area. Thanks for your interest.

I strongly believe that a math student who is preparing to become a teacher needs a strong math/liberal arts program. The student's fifth year should be a residency with an experienced math teacher. Practical versus theoretical application of knowledge.

I teach school every day. Going to school after school is over is a burden to me. My wife and kids come first.

I think that a uniform curriculum throughout the state and a minimum set of courses taken by all Math Teachers would insure that all students would be given an equal opportunity to learn Mathematics.

I think that use of computers can help in providing useful activities and applications in the classroom - some programs (like "Green Globs" and "Geometric Supposer" are useful learning tools, but more realistic applications need to be developed and disseminated among educators.

I think the idea presented in #22 is a fantastic suggestion and would enable more teachers to expand their education.

I think there are too many students who are not learning the basics in lower grades. Therefore, they are not prepared for high school, etc. Seems to be a lot of lower level math courses in our high school. I think more should be on the average - somehow.

I took no math courses in college but I always liked math. I was hired on a general certificate to teach part Math and part Home Ec. I have taken 9 hrs. in math and 3 hrs. in Models of Teaching in recent yrs. I believe I am an excellent Algebra teacher. I receive a lot of positive feed back from my past and present students. About 5 years ago I tried to get into a math education degree at USM but none was available. I am especially interested in knowing more about learning difficulties related to math and deepening my understanding of geometry and trigonometry.

I would like to see a more flexible schedule for courses at Orono. One night a week for 15 weeks is more than I want to take on at this point although I would enjoy some chances to talk and learn more about mathematics. Incentive is also a problem for me. I have a masters, so only a CAS would add to my salary scale. Also professional improvement is not recognized in my school for positions such as Dept. Head & committee work. Until there is a need for some varied senior classes, there is little need for me to broaden my own math background. I am interested in developing a better General Math course.

I would love to have a Masters degree in mathematics, but the remote area I live in makes it difficult to do so. Orono should offer extensive use of telecommunications system.

I would love to see opportunities for those who already hold advanced degrees to learn some more math, perhaps import someone for a weekend mini-course at the Samoset, or start a seminar program, where interested teachers could speak on their favorite topic.

I would really be interested and would definitely pursue a Masters degree if I could attend the campuses listed in #21. I hope this survey shows that the need for such a program exists!

I would take more courses within Mathematics both undergraduate and eventually graduate if more were offered during the evenings during the school year. Would also like to see courses taught in the Computer Science field.

I would work on an M.Ed. but I will not spend summers at UM and will not travel to UM. There is no financial reason to get an M.Ed. I will not take courses with overwhelming work assignments and will not take courses with instructors who are wasting my time.

I'm teaching geometry - low level and wish that I had some type of methods in math education to do this.

I've taught Math and Physics in both College and High School for over 10 years each. Most of the time I know more than I need to know to do my job. The battle is to find the mental and physical energy that high school teaching requires. Many older more experienced

teachers don't need more courses, as such courses would likely NOT change their teaching. I'm sure many math teachers need more background, however. Ideally, this background should be gotten before they enter the teaching field rather than after.

If the state truly wishes to provide incentives for students to study to become math teachers they must provide the money. Simply raising the standards for certification will only increase the shortage of math teachers.

In order to improve my understanding and practice in teaching mathematics, I am taking correspondence courses from Ohio University. I have no other reasonable alternative.

In the last 25 yrs. I have seen a number of surveys, such as this one with good intentions to improve the math program. A few programs have reached their goals; NSF, for example. The problem most of these surveys is the lack of follow-thru. Very few seem to get off the printed page.

I believe success can be obtained if the local curriculum coordinators, principals, math teachers & college professors are directly involved with development of programs within a geographic location. Example, St. John Valley, Central Aroostook, etc.

Interactive Telecommunications has tremendous potential! Thanks for showing interest in meeting the needs of Maine's math teachers via this survey.

It will always be a challenge to recruit top-notch Math Ed. students for these are the people that have the ability to work for high-technology high-paying companies unless educators in Maine get a substantial pay increase.

K-6 teachers require certification in math to teach it. It is the Achilles heel of math (and science) education.

Locally speaking, we (and probably most teachers and departments.) feel isolated from surrounding school systems and we need to know what goes on elsewhere. Some kind of independent research and data gathering mission about geog. adjacent math curriculums would help us to evaluate our own and then to improve or expand upon it.

Many math teachers that we are receiving at the high school level do not really have the understanding of the underlying concepts of higher math. Instead, they are people who were good (not exceptional) math students during their secondary years. Many of these people have expressed the desire to teach elementary level but they were turned off to this because they don't want to teach all subjects, i.e., history, English, etc.

Math classes need to be restricted to 20 students, in the middle-averaged classes. More than 20, and the student who needs the most attention is not getting it.

More local area (of state) conferences covering selected subject areas

More needs to be done to improve and enhance the quality of Maine's teacher training, including setting higher standards for admission to the College of Education so that it isn't regarded as 'easier', and primarily for those who can't 'make it' in the other colleges. Unfortunately, standards in the College of Education seem to be far below those in other colleges, thus teachers often do not meet the qualifications demanded of those they teach.

More than anything I want my Masters degree and if you could aid me or point me in the direction of some, I would appreciate, especially being a graduate of U Maine Orono.

Most of the courses that I have taken have not been in the field of math but in the areas of teaching in general; classroom management, the ways students learn, how we think, left and right brain, etc.

Most students are in the schools to socialize with their friends. Their jobs are more important to them than school. Unless we change Public Education we can expect what we're getting. I believe Ted Sizer and his essential school idea is a good direction to take.

None

Orono should also offer a variety of courses to choose from

Orono should also offer flexibility with course requirements

Orono should also offer required courses in the evening session (Fall & Spring) as well as during the day

Orono should also offer required graduate courses more than once during a two year period of time

Orono should also offer some evening and summer courses offered at Orono and other University sites

Our math teachers are also computer science teachers - we all could use "several" courses that cover computer programming (Advanced Placement.), computer software, and computer hardware.

Prospective teachers don't need so much to take high-powered math courses as they need exposure to competent and experienced teachers, so that hopefully they can learn how to control classroom situations, learn other approaches to teaching, see what & how students should be expected to do; learn, and behave.

Providing extra salary to those who have reached the highest level of certification would help. Giving an extra stipend to those teaching in hard to fill curriculum areas is another way.

So much of what is presented in methods courses as an undergraduate is lost due to the lack of hands-on experience.

Some of these programs sound great but should have been done years ago. How come none of these things are being considered for the Lewiston/Auburn area?

Specific goals need to be set forth for the entire math program with the assistance of college professors' input so that common ends may be met. The idea that an adolescent has to learn, understand, and remember a new topic everyday during his/her math career is ridiculous. No wonder college professors believe they aren't learning anything. This pressure sifts down to the lower grades so that nowhere in a child's mathematics endeavor does he/she get the chance to really learn a concept and then explore its application. Based on this there is no mathematics education, there is only an empty space in a child's mind designated for mathematics and the goal of the teacher is to fill it.

Teachers who deal with the non-college prep. courses should have special training - and they need not necessarily be math majors.

Thanks for asking and for the recent efforts in upgrading teacher training and graduate programs!

The "networking" being supported by the Dept. of Education has provided information, a sharing of thoughts and ideas, and helpful guidelines for the curriculum development in which my school is involved.

The continuing furor over certification, the so-called "master teacher plan", and all the other rules and regulations coming from Augusta and made by people far removed from the classroom are lowering morale and incentives for good teachers to remain in the classroom. Until teaching offers more rewarding experiences, good mathematicians will go into industry where they are appreciated.

The entire scale of math can be improved upon by initiating accountability on the University level. Methods of teaching and insuring understanding are imperative from "profs" if there is any hope of the future math teachers being capable of teaching so that students not simply learn, but understand

The fact that you are conducting this survey is encouraging. Over the years too many math teachers have been taking re-certification credits in non-math areas. You now have to make math course offerings available to these teachers.

The interactive telecommunications system would really meet a need for us in Washington County.

The State of ME must not discourage future teachers in the area of salaries. We need more teachers in every school system so we can have smaller classes. This way, the students can get more individual attention. It is very difficult to teach 25–30 low level Algebra students and be able to give them all of the attention and help they need.

The students I get at the 10th & 11th grade level are terribly "math ignorant". They can not apply any math to any amount of practical problem-solving - particularly in the area of industrial/vocational application. They have no idea whatsoever on how to begin "setting up" or analyzing problems. And even after figuring out how to "set up," they can barely do the arithmetic operations required to find the answer. They can't understand or use proper units of measurement. They also have no ability to "estimate"—to check if their answers are even "in the ball park"—and make sense! In my observation, their math experience since grade "K" has been virtually worthless!

The test which is now being given to prospective teachers should be eliminated. If a 4 yr. college cannot prepare a person to teach., then something is drastically wrong with the system. ME is still on the bottom of the pay scale and we are acting like we are at the top. This test, along with some other requirements, are going to discourage young people from staying in the state. They do not have to travel very far to be paid what all teachers should be paid (not just the "master teachers") Certain people in Augusta should get their heads out of the sand and take a look at the real world!

There is too much fragmentation of math courses. Algebra and Geometry, etc. seem to be separate courses with little relation to each other. I think we should interrelate all math courses into Math I, II, etc. and correlate math, science courses more.

There should be a re-examination of what the State is mandating in the "Gifted and Talented Program".

This program is really needed. I hope you can do this Dean Cobb.

USM has been presented with a petition signed by more than 300 math teachers in Southern Maine interested in enrolling in advanced degree program like those outlined in this survey. Because of the intense paranoia from Orono, these program have been nixed. Why does Orono (or all places) need to hoard the real educational programs when USM is much more centrally located (population-wise). This attitude is hypocritical and counterproductive to Maine. It needs attention!!! NOW

We have to update our courses.

Solve: $x^3 + 6x^2 + 12x + 24 = 0$
Now use an HP 15C
Bingo!
What should we be teaching?

We need a more vigorous state-wide organization that serves the needs of math teachers in Maine.

We send successful students 18 M.I.T., other engineering programs, etc. so we must be sound.

What about tuition assistance and/or fellowship availabilities?

What is the lead time on course offerings to make plans?

When I read math journals, very seldom do I see how it applies to my teaching. That's why I don't belong to various organizations and subscribe to different periodicals.

Why (?), under Math Ed. Courses For Secondary School Teachers, do you list 8 topics that, to my knowledge, have never been offered before and then say "Mark Three or Less". I would travel to any of the places I indicated in #21 to take any of the 8 suggested courses.

Why go for a Masters and shell out more money when our salary isn't letting us live comfortably now?

345 no responses